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5aAAa9. The system (software) for acoustic and lighting calculation (SCAL) program like support for acoustic and lighting conditioning in interior spaces

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This work aims to show an alternative software tool for calculating the acoustic and lighting conditioning and comfort in interior spaces. This program is developed in a desktop version and it can run on different operating systems because it is multiplatform. It is easy to operate. Program tools allow a quick calculation because the system values are stored standards of acoustics and lighting through an intuitive interface. The calculations can be stored and open for future modification; also, the results can be summarized and printed. The activities for its development and validation were: 1) Survey on the requirements and interest that the system should contain. 2) Implementation of the program: It conducted jointly between subject architecture specialists and computer engineers. 3) Development of training materials for the understanding of the functioning of the application. 4) Testing and evaluation period: The functional and non-functional requirements were evaluated and verify if the obtained results would be the expected results.

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1. INTRODUCTION

Regarding the acoustic preparation of architectural spaces, means the same as the one you are looking to get acoustic conditions more suitable for their activities.

To obtain adequate acoustic comfort and speech intelligibility correct, there must be a good acoustic planning based on consideration of factors that influence their sound insulation, as reverberation time, in its lack of harmful echoes, in its degree of speech intelligibility among others.

The noise level indoor environments possessing certain types of noise depends mainly incident, the formation of traffic routes, the distance thereof and finally the building envelope characteristics that make the various facades. In this regard, there are two variables that can be considered: the acoustic isolation of the closure element and the potential attenuation caused by the shape of the facade plane.

First, you must know the local requirements. This information is obtained from the interaction with designers or, in a more direct relationship with current or future users of the space once built.

Then arise functional requirements such as minimal surfaces to develop the planned activities, the need for physical communication between local visual control or desires to have or illuminated naturally ventilated environments.

Turning now to the conditioning lighting, we understand by it the attitude of giving some lighting conditions to a place. That place is referred to as the architect designs spaces and conditions refer to features that are defined for these spaces, which pursue the ultimate goal of obtaining the user's visual comfort.

In the conditioning of indoor lighting, the most important thing to consider is the task in the same, and, therefore, the amount of light needed for such a task view.

When we put a space luminicamente may refer to the fact natural lighting design, artificial or both together. In this paper, we consider artificial lighting.

To condition a space, either acoustic or luminicamente, we perform calculations on, in each particular case, sound insulation, absorption materials, reverberation times obtained critical distance, lamp power, distance to the plane of the luminaire work, etc..

On this basis, the Working Group raised the need for a software tool to facilitate and accelerate the achievement of the above calculations.

This raises SCAL (Calculation System acoustic and light).

2. SYSTEM DESCRIPTION AND APPLICATION

2.1 Requirements and Objectives

According to surveys conducted for the project found that the system must meet the following characteristics:

• Cross-platform: it should run on any OS system.
• Scalable: Indicates your ability to react and adapt without losing quality.
• Intuitive: It's easy to follow the different stages without knowing the system.
• Accessible: By downloading, allowing an installer runs on any operating system installed.
• Accurate: the calculations performed by the system must be obtained precision and accurate.
This proposal seeks to verification by measurement and calculation of some parameters for acoustic and light fittings.

2.2. System description

This is done as appropriate to consider conditioning:

2.2.1. Acoustic Conditioning:

SCAL is a platform that can store data on specific gravity of materials, reduced background noise by frequency and by mass x surface envelope architectural elements and their respective levels of sound absorption, room types and maximum levels allowable noise (Figure 1). This makes storage possible future calculations as they are data that can be used in the analysis of different types of architecture.

![Figure 1. Valores stored: Shows the materials can be stored and how.](image)

Once selected data base taking the room type (or types of space: room, office, etc..) Can start the calculation by entering the room volume, the number of enclosures, these enclosures materials, and power source.

The program calculates: the directivity factor of the sound source, the distance from the source, the critical distance and reverberation time, and generates a report that can be printed and / or saved for future modification.

2.2.2. Lighting Fittings:

For indoor lighting, this software tool to calculate the source strength in a given work plane. This is very important because it is necessary to determine it based on the task that is to be executed, for example, for a reading room and 200 lux required for an operating room of a hospital about 15000lux.

The program can calculate the intensity of the source on a plane with any slope (horizontal, inclined or vertical) as it depends on the angle of incidence of the light beam on said plane.

Furthermore, it also has application to perform the calculation of light intensity at a particular point in a graph, which was held for a grid in which to locate the distance of the light source in relation to a plane, the angle forming incidence, the intensity of the lamp, etc. (Figure 2)
2.3. System Application

This program for the calculation of acoustic and light fittings can be used for any type of interior spaces of shared or private, meaning the last full concurrency enclosed public or private with a normal degree of small to medium occupancy. Is neglected in this case greater spans premises where the preparation must be done in a special way.

3. PROCEDURE FOR APPLICATION

Then, two cases were developed to show its use and operation.

3.1. Acoustic Conditioning

The calculation begins with the loading of the specific weight of the materials, coefficient of absorption of the elements and background noise allowable for a particular room. (Figure 3, 4, 5).

Figure 2. Grid to position the light source and the plane of incidence.

Figure 3. Data Storage.

Figure 4. Stored values: Reduction of a material due to its mass and frequency.
Continue the calculation describing types and number of enclosures, thus obtaining the NIA and the reduction achieved by them. (Figure 6).

The program generates a summary based on the previously entered data and calculations. (Figure 7).

3.2. Lighting Fittings

Start typing calculating intensity and distance from the source. Through this platform we can get the light intensity at a given point of local analysis. Thanks to these results we know if we are using the lamp is just right for the role we perform in the same venue. We can get the light intensity in a direct horizontal point (Figure 8), for example study table, in a vertical plane (Figure 9), eg classroom blackboard, or in one horizontal at an angle of the light beam (Figure 11). The calculation can be performed analytically or graph (Figure 10).
Figure 8. Method intensity graph to obtain a given point in a horizontal plane at a point perpendicular to the working plane.

Figure 9. Method intensity graph for a particular point in a vertical plane.

Figure 10. Calculation of light intensity in the vertical plane (e.g., classroom blackboard). When entering data (intensity, distance and angle) long program outcome based on the calculation mentioned in Fig.

Figure 11. Calculate light intensity at a point not perpendicular to the light source.
4. PROGRAM IMPLEMENTATION

The implementation of the application was made in the JAVA programming language using a database
HSQl applying agile methodologies for development. The same was done in collaboration between
specialists in the field of architecture in the subject and computer engineers.

![Netbeans Development Environment](image)

5. DEVELOPMENT OF TRAINING MATERIAL

Was developed for the compression performance of the application a user manual. In the same explains
the functions of the application, the options and values that must be entered for the correct use of it.

![User Manual](image)

6. TEST AND EVALUATION PERIOD

Through tools “testing” evaluated the functional and non functional requirements to determine the
correct development and eliminate errors that could get in the continued use of the application.

The application was used by specialists in the field of acoustics and lighting.

7. CONCLUSION

We conclude that this platform enables quick and easy calculation of acoustic conditioning and lighting
in an educational and accurate.
It has the advantage of being cross-platform, allowing to be used on any operating system with an open language with strong community support.

The use as an educational system allows learning concepts of acoustics and lighting as well as their use in real life, with practical examples and normalized values.
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