



Expert system to achieve certification for the sustainability of a building

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Abstract

The current BREEAM platform is a software tool that enables building assessors to register projects for which they want to obtain a sustainability certificate, and follow its certification process, which by an ordered exchange of documents between the assessors and the BREEAM technicians, the obtainment of the desired certificate.

One of the main documents needed for the obtainment of a BREEAM sustainability certificate that are currently sent forth and back between the assessors and the BREEAM technician is the evaluation form, which is the main focus of this project.

1 Introduction

BREEAM (Building Research Establishment Environmental Assessment Methodology) is an evaluation and certification method of building sustainability [1]

Currently, the actual BREEAM platform is a software tool that allows the register of projects by assessors who want to obtain a BREEAM sustainability certificate and to follow the certification process of the registered projects until the obtainment of the desired sustainability certificate. The certification process of the projects is completed through a series of exchange of documentation between assessors and BREEAM technicians.

One of the main steps for obtaining a BREEAM sustainability certificate is the completion of a sustainability assessment of the project. Right now, the assessors who wish to complete the sustainability assessments have to go through a manual system, which is based in filling documentation and sending it to the BREEAM technicians. These technicians are in charge of verifying that the assessment was done in a correct way and that the filled documentation are truthful to the building that was or will be built.

This is an expensive, slow and difficult to expand process, as it implies a manual bureaucracy for the follow-up of the construction projects that are being verified. Once a project is verified, the BREEAM technicians have to either generate the certificate, filling manually the scores obtained in the sustainability assessment if the document is correct; or hand-write a document containing the wrongly justified sections, in order to send it to the project assessor so he corrects

the document and sends it back, or he provides proof that the previously sent form was correct. With this in mind, this project has its main focus on the digitization and automation of this process and its consequent integration on the current BREEAM platform.

2 Objective

Concretely, the main goal of this work is the creation of an expert system that uses the evaluation logic of the technical manual used by BREEAM to digitize and automate the generation of dynamic forms that have real-time updates, after which the structure and views of these forms have to be developed on the frontend, and finally, the consequent integration of both the expert system and the frontend side of the evaluation form into the existing platform that manages the process of obtainment of a sustainability certificate.

3 Results

3.1 Evaluation form

The evaluation form, which digitization is the main focus of this project, is a form that as it was stated in the introduction, assessors have to fill and send to the BREEAM technicians in order to obtain a BREEAM sustainability certificate.

This form is conformed by a set of different categories such as energy, contamination... in which the building they want to obtain the certificate for is evaluated.

Each one of these categories has its own set of questions, grouped in issues, which can have different types of answers, as it may need the assessor to select one answer or check all the answers that apply from a list of possible options, to write a numerical quantity or a date or to not answer if it doesn't apply.

For all the answers given by the assessor, he has to provide a justification or evidence that the building complies with the answers.

For the score of the form, every question has to possess a score, which will be the number of points acquired with the answer. The score for an issue will be the result of adding the points received from each question which belongs to said issue, and the category score will be the percentage of points acquired from adding every issue score inside that category, having as the limit the maximum score obtainable in that category.

Lastly, the final result will be a weighted average of the result of every category, with each category having a different weight.

Adding to this final score, there are some questions in the form that have some answers that alongside the normal points, also give exemplary credits. This credits, if obtained, add to the value of the final score but they are not taken into account for the limit of the score, making it so they can only add value and never lessen it.

When there is a final result, this result will be transformed from a numerical value to a qualitative classification depending on the range of the final result.

There is an exception to the previous qualitative score assessment because along the form there are some questions that need to be answered in a certain way to allow the qualitative score to pass through a certain threshold, otherwise the score will stay at the threshold value. These questions, alongside their needed answers to pass the threshold, are known as *minimum standard* questions, as they set the minimum standard needed to reach a specific classification.

Figure 1: View of the questionnaire.

3.2 Decision on the form structure

First of all, the questions of the form are grouped and divided inside the test according to the next hierarchy: The test is divided in different categories. In each category, the questions are also grouped in issues, which are sets of questions of the same category that are related to each other in some aspect.

The form contains four different types of questions in respect to the type of answer needed:

- **Accordion:** Type of question where there is a selection of answers and the user has to select one from that list.
- **Checkbox:** Question with more than one answer where the user has to choose every answer that applies.
- **Date:** Question where the user has to choose a date from a calendar.
- **Number:** Question where the user has to write a numerical quantity.

An example of a questionnaire can be seen in figure 1.

4 Conclusions

The creation of an expert system to digitize and automate the generation of dynamic forms with real-time scoring for a specific building project schema and its integration into the current platform which manages the process of obtainment of sustainability certificates.

References

- [1] Antonio Sánchez Cordero, Sergio Gómez Melgar, and José Manuel Andújar Márquez. Green building rating systems and the new framework level (s): A critical review of sustainability certification within europe. *Energies*, 13(1):66, 2019.