Cost-Based Decision Model for House Interior Design

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Abstract

Decision Support System is an interactive computer-based systems that intended to help decision makers compile useful information from raw data, documents, personal knowledge, and/or business models to identify and solve problems and make decisions. The proposed system supports to make decision for interior design of the buildings. This system develops an information model to support cost-based decision making in the interior design phase. An interior design object library is developed by collecting interior information attributes and designer's sample designs together with their respective prices. It can reduce the complex calculation of cost analysis for the whole building. It can support easy to choose the interior design (floor, wall, ceiling, window, door and lighting) by the client who has no design idea. Using this system can easily analyze the design and cost of the whole interior parts of the building.

1. Introduction

Interior Design is a profession concerned with anything that is found inside a space - walls, windows, doors, floors, ceiling and light, etc. All of these elements are used by interior designers to develop a functional, safe, and aesthetically pleasing space for a building's user.

The work of an interior designer draws upon many disciplines including environmental psychology, architecture, product design, and traditional decoration (aesthetics and cosmetics). They plan the spaces of almost every type of building including: hotels, corporate spaces, schools, hospitals, private residences, shopping malls, restaurants, theaters, and airport terminals. Today, interior designers must be attuned to architectural detailing including floor plans, home renovations, and construction codes. Some interior designers are architects too.

A room design is a consistent idea used throughout a room to create a feeling of completeness and a whole mole. The evolution of interior decoration themes has now grown to include themes not necessarily consistent with a specific period style allowing the mixing of pieces from different periods. Each element should contribute to form or function or both and maintain a consistent standard of quality and combine to create the desired design.

In the early stages of a housing project, many interior design alternatives remain to be confirmed after a rough review of the costs. It is necessary to determine the costs during the decision making process for interior design items in an apartment unit plan. In general, interior designers consider the overall concept, color and style according to floor plans, spaces and elements.

The clients' requirements are stated in ongoing communications among project participants in the early phase of a project and become embodied in the design phase, during which design alternatives must be selected to meet the clients' requirements while satisfying them in a realistic way.

All of these elements are used by interior designers to develop a functional, safe, and aesthetically pleasing space for a building's user.

The proposed system aims to devise a system that allows clients to make cost-based decisions suited to their own interior design specifications and that enables the builder to plan resource requirements and budget costs. To choose the satisfied items for client, we already collected interior items in an interior design library. We describe an information model that supports cost-based decision making in the interior design phase.

2. Background Theory

2.1 Decision Support System

Decision Support System (DSS) is a specific class of computerized information system that supports decision making activities. It supports decision makers who may be manager level or individual or group of users in semi structured and unstructured problems. It also supports modeling and analysis.

Typical information that a decision support application might gather and present would be: an inventory of all of your current information assets (including legacy and relational data sources, cubes, data warehouses, and data marts), comparative sales figures between one week and the next, projected revenue figures based on new product sales assumptions; the consequences of different decision alternatives, given past experience in a context that is described.

Using the relationship with the user as the criterion, there are three types of DSS: A passive DSS is a system that aids the process of decision making, but that cannot bring out explicit decision suggestions or solutions. An active DSS can bring out such decision suggestions or solutions. A cooperative DSS allows the decision maker (or its advisor) to modify, complete, or refine the decision suggestions provided by the system, before sending them back to the system for validation. The system again improves, completes, and refines the suggestions of the decision maker and sends them back to her for validation. The whole process then starts again, until a consolidated solution is generated.

2.2 Related Work

Mardjono [2] proposed a decision support system (DSS) that might be useful for designers when they design a bamboo building. It presents an early-stage design process of bamboo building and the development of a DSS. The architecture of this system is based on the theory of DSS and knowledge of bamboo that should be integrated in the design process of bamboo building. In this system, there are three components: a DSS, design process, and knowledge of bamboo. The process starts with determination of the building system, database construction of bamboo building parts, and the rule for using bamboo in each building part. The process focuses on systematization of each design stage and integration of the building parts to construct a monolith bamboo building.

Hossam [4] presented a GIS-based decision support system (DSS) that can be used to analyze the effect of sediment delivery on the sustainable development of the reservoir. In addition, the decision support system (DSS) can help to evaluate present sediment deposition trends, and identify areas for future monitoring needs. This decision support system (DSS) ensures faster and economic means for quantify and located the sediment deposition in the reservoir. It is also designed to help the decision makers and agencies in making watershed management planning.

2.3 Cost Based Decision Model

Then interior designers propose designs and alternatives, and the results are initially reviewed without any consideration of cost. In the detailed design stage, the owner/developer does review the interior design accompanied by costs. However, the procedure is a long one, and is subject to many problems in feedback concerning alternative design proposals.

Parametric cost estimation models have been developed. Regression, or multiple regression analysis as it is usually called, is a very powerful statistical tool that can be used as both an analytical and predictive technique for examining the contribution of potential new items to the overall cost estimate reliability. It is not appropriate, however, when describing nonlinear or multidimensional relationships with multiple inputs and outputs. In addition, it is difficult to use parametric methods when the number of alternatives tends be infinite, based on the different items of the design.

Therefore, we propose a procedure in which designers use an Interior Design Library (IDL) to select an interior design item based on cost. At that point, the total cost for the interior can be reviewed.

3. Overview of the Proposed System

3.1 The Design of the Proposed System

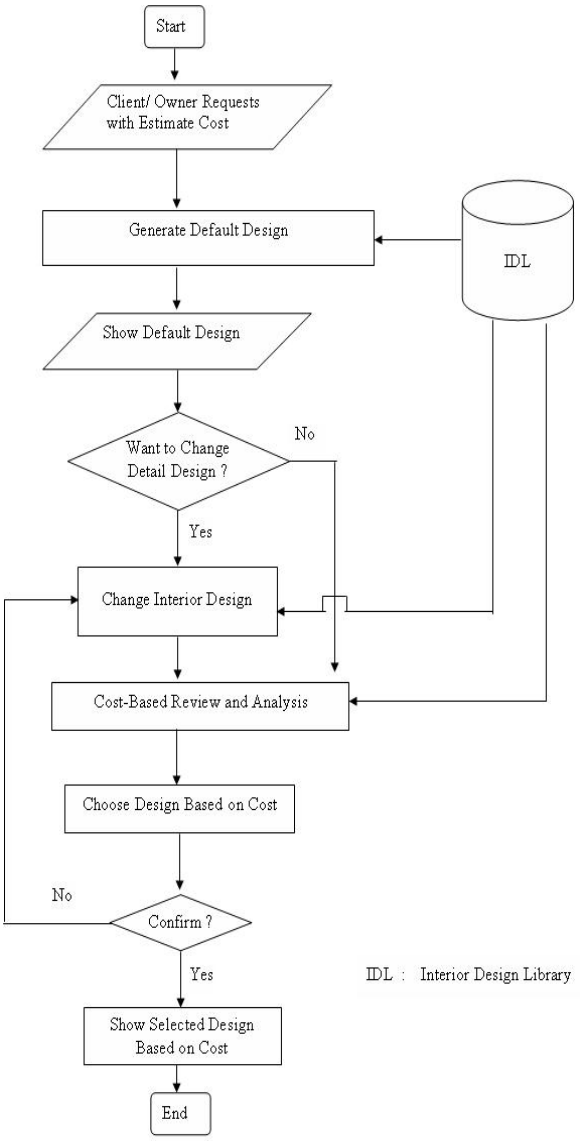

Figure 1. System Flow Diagram of the Proposed System.

Before the client use the system model, Interior Designer collected the default designs to the database. The System Administrator also collected the interior design items with detail facts such as color, material and costs, etc. The system flow diagram is shown in Figure 1.

First, the client or owner who want to choose the optimal interior design for his/her building, requests for the design with estimated cost. The system generates the default design for the requested room types on the similar estimated cost. Then, the system asks to the user for changing the interior items' design.

If the client wants to change about the detail interior design, he can change the item details as he like such as floor material, wall color, lighting fixture, etc. After changing the design, the system reviews the total cost for the building's interior design and compares with the default design. Then, it selects a design according to the cost comparison and show the design to confirm to the client if the client has not satisfied yet, he can change more designs.

The system reviews and compares the costs among the designs that the client chose, and the default design. This process is doing until the client satisfied the design. Finally, it selects and shows the client satisfied design. The cost based decision model is shown in Figure 2.

- Accept Estimate Cost
  - Search in Default Design
- Show Default Design
- Calculate Default Design Cost
- do
  - Accept Design Changes
  - Calculate Client Selected Design Cost
  - Compare Cost (Default, Client Selected)
  - Generate Recommended Design
  - Confirm to Client
- While Client Satisfied
- Generate Final Design

Figure 2. The Cost Based Decision Procedure.

3.2 The Interior Design Library

The Interior Design Library (IDL) is a database which contains floor, wall, ceiling, door, window and lighting tables. Each table includes itemType, Name, Color Material, Pattern/Texture, Unit, Unit_Price, and imagelink. IDL also includes the DefaultDesign table and SelectedDesign table. DefaultDesign table consists of DesignID, RoomType, Floor, Wall, Ceiling, Door, Window, Lighting, Area, and TotalCost. The interior designer or system builder first inserts the designs to the DefaultDesign table as the default designs. When the client selected the designs, the system records the select designs into the SelectedDesign table. The database design of the Selected Design table is shown as follows.

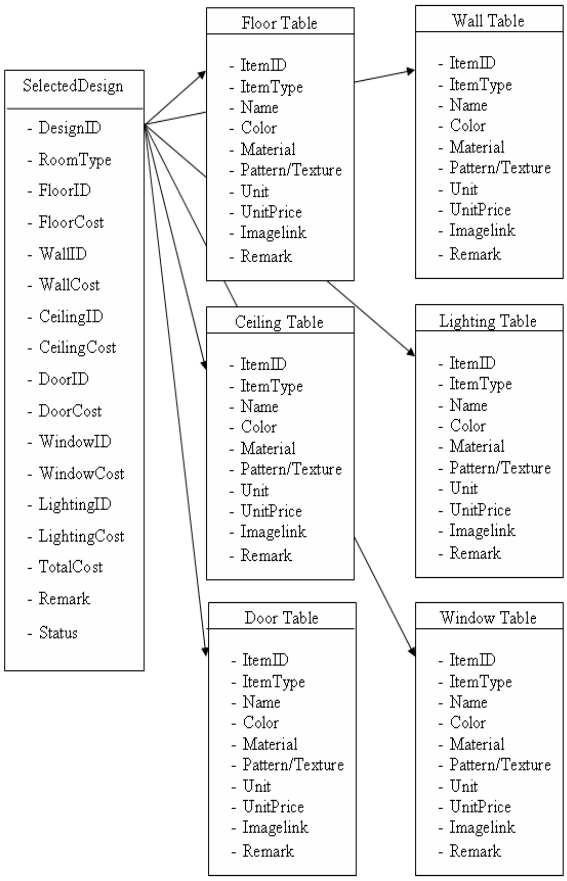

Figure 3. The Database Design of the SelectedDesign Table.

4. Case Study Implementation

We implement this system using C#.Net and Access database. In this system, the user can choose the new design for new house. First, the user chooses the room type to select the new design. Room types include entrance room, living room, bed room, dinning room, kitchen room and bath room. For each room type, the user has to enter the estimate cost that he\she wish to use. The user can retype the estimate cost before saving to the system. The system can select the default design that is plus or minus 30 $ of the estimated cost. The new design form of entrance room and living room are shown in Figure 4 and 5. The user can also see the images of the interior design objects such as floor, wall, ceiling, door, window and lighting with their respective unit cost.

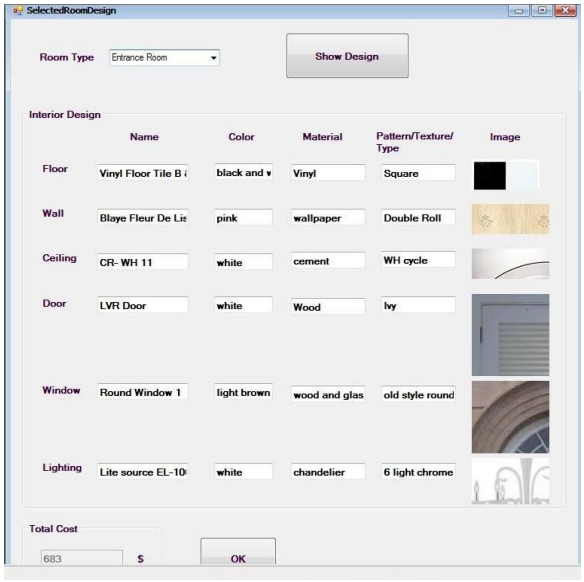

Figure 4. New Design Form for Entrance Room.

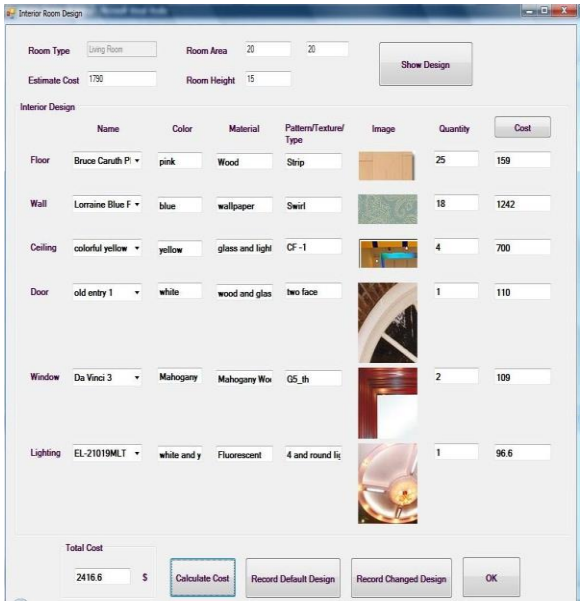

Figure 5. New Design Form for Living Room.

If the user does not like the default design, he/she can choose new floor type, wall paper design, ceiling type, lighting, door, and window design. The user can choose the design for each room.

After choosing all room types, the system finally select the minimal cost design as the new design for the user. The selected entrance room design is shown in Figure 6. The user can choose the room type and see the selected room design.

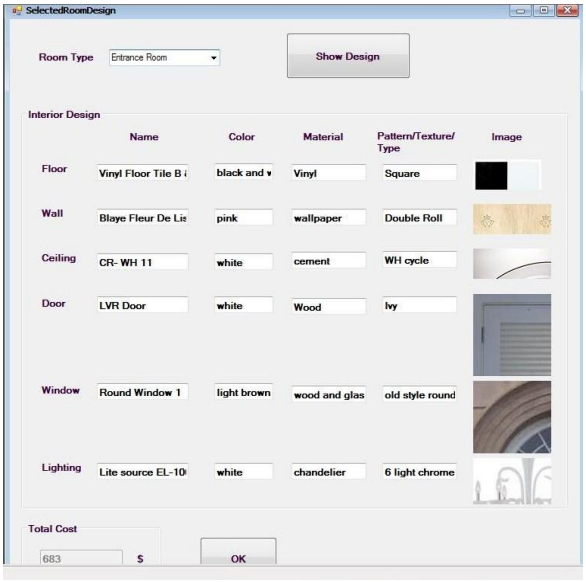

Figure 6. Selected Entrance Room Design.

After the user has chosen all the design for all rooms, the system will show the comparison of default design and user selected design and costs as show in figure 7 .

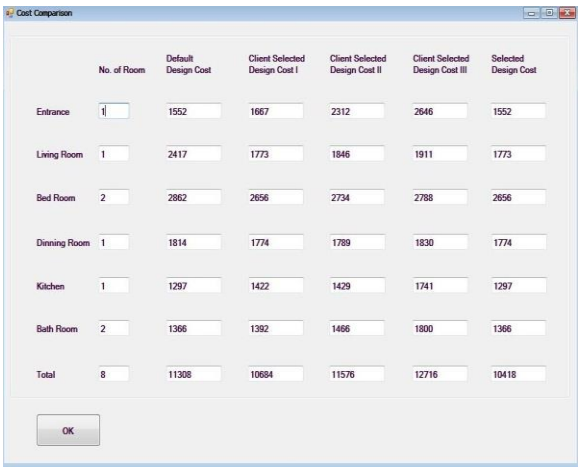

Figure 7. Comparison of the Design Costs for all Room Types.

5. Analysis of the Design and Cost

The system allows the user to choose the interior objects design of six room types. Then the system selects the minimal cost design for each room among the user selected designs. The comparison of the costs of the default design and user selected designs for six room types is shown in Figure 8. The user can see and compare the design costs. If the user does not like the selected design, he/she can choose any one of the satisfied design among selected designs.

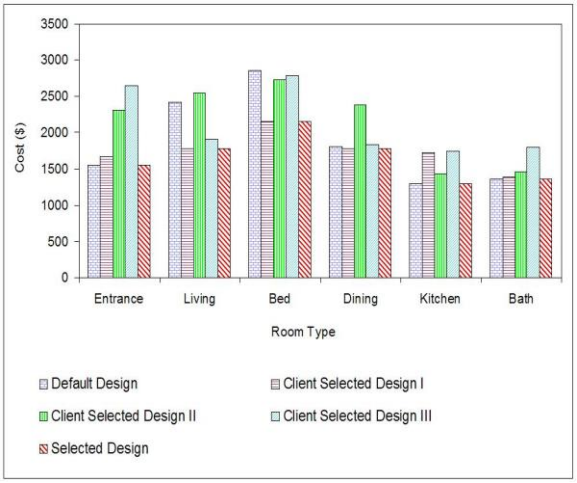

Figure 8. Cost Comparison Chat for Six Room Types.

6. Conclusion

The proposed system can review and analysis the costs of the interior designs for entrance room, living room, bed room, dinning room, kitchen room and bath room. It is described as an information model that supports cost-based decision making in the interior design phase. The client can change the interior design until he is satisfied of the design and review the cost comparison between the default design and selected designs. Finally, the system selects one minimal cost design for each room. Therefore it can reduce the complex calculation of cost analysis for the whole building. It can also support easy to choose the interior design by the client who has no design idea. The proposed system can allow choosing the designs that the user satisfied and select the minimal cost designs. In addition, this system provides the collections of the interior decoration objects like floor, wallpaper, ceiling, door, window and lighting.

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