

INTERACTIVE FEASIBILITY-BASED CAAD SYSTEM FOR INFRASTRUCTURE AND OPEN SPACE PLANNING IN HOUSING PROJECT DESIGN

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Abstract. The decision support system developed in this research is aimed to the conceptual scheme of project focusing on infrastructure planning and open space design in the architectural context for housing project. Alternative design sets are provided within the limitations, and possibilities to be further evaluated appropriately. This system helps architects and developers to analyze relationships of physical environment, architectural requirements and the overall of project-related factors with real-time cost estimation. Factors for cost estimation derived from the beginning to the end of project will be manipulated simultaneously. Architects and developers can use this design simulation to address the physical data with real-time cost estimation, provide alternative results, and design evaluation for overall project's feasibility. The software of our research is not just a tool for design & planning automation in feasibility analysis. It will be an interactive decision support system for both developers and planners aspects. The system was developed by SketchUp Ruby Application Programming Interface. The results will be presented into two ways. Firstly, 2D and 3D modeling will be used for interactive visualization in design and planning of the beginning process. Subsequently, numbers and additional factors in details will be used to show relationship between architectural environment and feasibility-based information to help architects and developers collaboratively analyze the land use planning and open space design for housing project. In evaluation process, the developed software is tested with the project preceding and the future project of Bangkok area under constraints and regulations of Building Control Act of Thailand. In conclusion, this system will make effectiveness in design process and management of the construction knowledge. The decision support systems should be designed to makes explicit use of both planning analysis aspect and knowledge-based decision making.

1. Introduction

Project planning design is a very important process in commencing a project. The design of the project gives a clear picture for the owner to see the possibilities and ways to set up a project, and indicates if the project is legal, and would be constructed according to the standards or not. This step also let's the owner see the outline of the entire project, which can lead to better investment plans. The project planning design gives the clear picture for both the architect

and the real estate developer on how to divide spaces of the project into suitable and effective sections. Then, they would be able to come up with the suitable design and calculate proper investment.

Nowadays, there are computer programs to help in the design and information analysis sections. The programs normally use step by step procedure, so it is flexible, and is easier to change and correct according to the needs during developing the project. With the help of the computer programs, all the information is filed and organized. Thus, it is the tool that simplifies the communication between the architect and the real estate developer. By seeing the project form in the program, they have the same perspective on how the project would be, such as facilities, spaces, environment, and building form. This understanding is essential in calculating the cost, which supports the decisions when creating the project.

2. Background

2.1. WHEN DESIGNING A PROJECT, THE EXISTING ARCHITECTURAL STYLE IS NOT ENOUGH TO SATISFY THE NEEDS OF THE NEW CONSUMER LIFESTYLE

The designer needs to be cautious when designing a landscape that has a unique natural environment. The plan has to be carefully developed to ensure that there is minimal, or if possible, no effect to the environment to prevent environmental decadence. Proper design plan not only reduces the effects on the environment, but also raise the touch of nature in the project, which makes the project much more alive and personal.

There are 2 elements in designing landscape: roadway system and open space network. In order to create a community with good infrastructure, the 2 elements have to be developed hand in hand. Moreover, space usage and landscape must be carefully designed to create a good living environment. Therefore, owner needs to ensure that the project has a proper infrastructure and open space, and has creative landscape design.

Nowadays, the consumer's desire is the priority in creating a project. The most important thing that the consumer needs is not concentrated on good design. It is more important to create a pleasant living environment. This has become the core. Therefore, the designer must focus on that core alongside creating a good design.

2.2. THE REPENTANCE OF THE DESIGN WORK AND THE POSSIBILITY OF THE PROJECT COST

Computer programs are continuously developed by various groups and entrepreneurs. There are both programs that serve ordinary usage of regular users and specific programs that are designed specially for certain users and purposes to make it easier to use. In the present, most design programs are developed to focus on designing than calculating and analyzing the design form in order to be able to choose the appropriate design for the project. There are also a lot of programs that can do both design and calculate. However, they still lack comparison in the two sides of the information in order to help choose.

Moreover, we also need to follow certain rules and regulations to create a good plan design for the project, which are the regulations concerning land allocation in Bangkok. The importance of the proportion of the issues, which are the size of the land, roads and pavement standards, necessary facilities and public services, must be suitable with the budget of the project.

3. Requirement Analysis

3.1. ALTERNATIVE DESIGN SUPPORT SYSTEM FOR INFRASTRUCTURE AND OPEN SPACE PLANNING IN HOUSING PROJECT DESIGN

According to the land allocation regulations, it indicates that there must be at least 1 open space for gymnasiums or parks for relaxing and personal entertainment. The size of the open space must be at least 5% of the entire project. It must have proper location, size, and site plan which has easy access, and each side must be at least 10 meters wide. It cannot be divided into several parts, except when each part has not less than 1 square rai. In the project that we chose to be our case study, the open space is divided into parts, which are more suitable spaces with convenient access than creating just one big open space. This creates variety of design considering the percentage of the site under the regulations.

3.2. COLLABORATIVE DESIGN FOR ARCHITECTS AND DEVELOPER

Architect and Developer, both are the software users but they have different perspective toward design process, factors, skill of design instrument, and analysis system. Architect is more skillful in design instrument and only considers his own satisfaction with aesthetic issue. In opposite, developer is more concerned on investment issue, as developer is very skillful in calculation.

Creating the ability of collaboration and most simplified to the software will analyze relationships of physical environment, architectural requirements and the overall of project-related factors with real-time cost estimation. This will also bring the design result increase the efficiency and reduce time in working process.

Understanding of initial outline of the project is able to do analysis of the project capital calculation to optimize it with the investment ability, and estimate the feasibility of architectural design. From the project outline, it will be able to calculate the area from its master plan to estimate construction cost, schedule, sale price, and other expenditures which are the project cost estimation.

4. SYSTEM DESIGN & DEVELOPMENT

The system was developed by SketchUp Ruby Application Programming Interface. SketchUp which is like popular general software that the facility gives the user can write order program adds , to help testify work with convenience and less time, such as MS-Office (VBA), AutoCAD (AutoLISP), also SketchUp, there is the RubyScript, which the user can develop and modified the order later. This develops of system will help in term of mind's pattern making that can happen for design's decision. That is different from the work that used to have the developing new pattern or just the same old program user's experience.

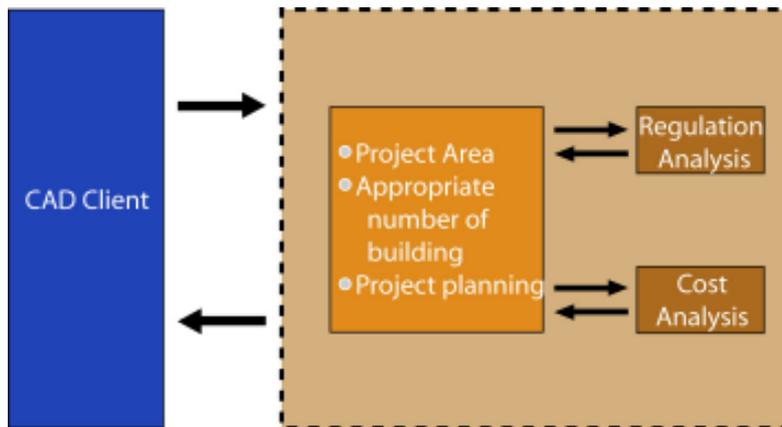


Figure 1. Proposed System Architecture.

4.1. DECISION SUPPORT SYSTEM FOR INFRASTRUCTURE AND OPEN SPACE PLANNING IN HOUSING PROJECT DESIGN

The decision support system developed in this research is aimed to the conceptual scheme of project focusing on infrastructure planning and open space design in the architectural context for housing project. Alternative design sets are provided within the limitations, and possibilities to be further evaluated appropriately. This research select the residential unit on “Town house” type that is the primary study case for develop another type in the future. This type is the type that’s interested by people economic change. In this type of project design will have many small unit of project that will take time to design in the condition and in the facility plan designed will see the different clearly when change the scale of project scale. In the analysis on F.A.R. and O.S.R. had a little effect to this type of building zone, that have permission to construction the project in law’s condition for the scale that impossible.

4.2. COMPUTER AIDED ARCHITECTURAL DESIGN WITH SIMULTANEITY

Simultaneity is the property of two events happening at the same time in at least one reference frame that are design process and cost estimation

4.2.1. Interactive Cost Estimation and Planning Design

In order to help decision makers evaluate overall project’s feasibility for decision-making in their investment. Factors for cost estimation derived from the beginning to the end of project will be manipulated simultaneously. Architects and developers can use this design simulation to address the physical data with real-time cost estimation, provide alternative results. There is database price system allows users to be modified later. After got the design from design’s part that can know the building cost from design space calculate, will be analysis the cost of investment and use it to manage the product cost that will see the possibility of project, More detail in Figure 2 information.

4.2.2. *Planning Design Integrated system*

Integrate, the planning project design process, with computer technology, so as to manage the construction knowledge basically that base in design process follow the basic laws and regulations, which is stipulation and tool for design decision-making to acquire the preliminary design. By the plan design, will start from site boundary to the work space for calculate the size of the street, built the pattern of infrastructure plan. Design about residence building part that analysis calculation for design on Clipboard Tool and it will be used to generate the sale area, knowing the sale area and build the project. After that user can bring the pattern from the condition to help the decision of design pattern and have the navigator part that will know this design's in law condition or not, for mind decision pattern. (Figure 2)

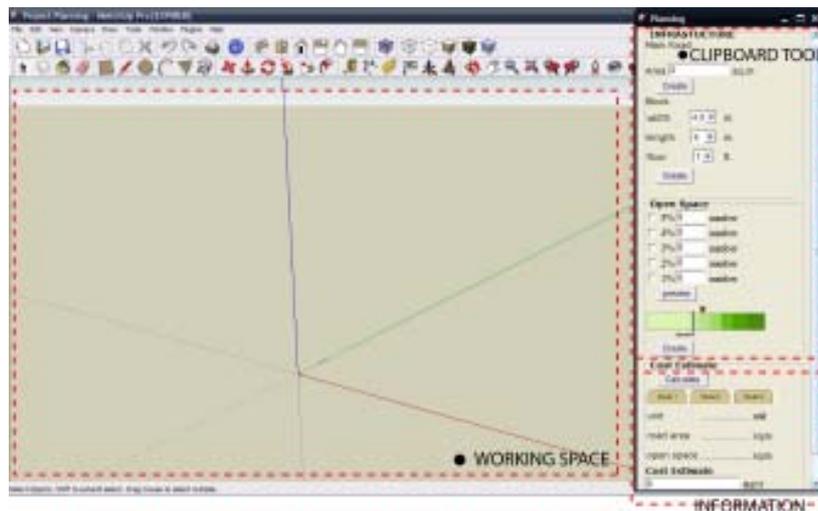


Figure 2. *Graphic User Interface.*

5. **Conclusion & Future Works**

This research purpose is to create a tool helping both analysis and design basic structure plan and open space. Which will be benefit to those user related in architecture and developer working in the way that easier to understand have an interaction with user, more adaptive, helping analysis create a work which concerning on project environment for living of communities

The study of this project, we use case studies, which are housing project design: townhouse. The future study may become useful, if we could apply some other factors those are necessary in designing analysis and support other kinds of projects such as single house or resort projects

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