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Utilization of BIM Technology, Autocad Software, and Sketch Up in Architectural Design Drawings

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ABSTRACT

Architecture is a science that studies designing a building by applying 3 principles, namely strength, function, and beauty. A building generally consists of a form or pattern in the form of 2 dimensions, for example, the floor plane, the ceiling plane, and others, and the shape/form consists of the shape/shape of a volume (3 dimensions), for example, the space in the building. In designing a building, an architect who is an expert in the field of architecture is needed. This study uses a descriptive method to find out how to make design drawing documents by utilizing BIM technology, AutoCAD software, and SketchUp. The results show that BIM technology, AutoCAD software, and Sketch can produce architectural design drawings more efficiently in terms of time, and cost and produce more accurate image quality. From the explanation above, it can be concluded that the results show that the use of BIM technology, AutoCAD software, and sketch-up in architectural design can produce architectural design drawings more efficiently in terms of time, and cost and produce more accurate image quality.

Introduction

Architecture is a field of science that not only designs the construction of a building but is also needed to learn about the art of designing buildings that use three basic principles, namely strength (families), function (utility), and beauty (venustas) (Warmadewa University, 1992). A building generally consists of planes and spaces. A plane is an abstract idea that can be interpreted as a flat surface, extending in all directions infinitely, and not having a two-dimensional thickness such as floor plans, ceiling planes, and others that have widths and lengths or heights and bases. (Boulanger, 2022). Shape/appearance Space is an element that expresses the depth of the impression of space and can be expressed in three-dimensional form, for example as space in a building. (Raden, 2021).

In designing a building, an architect who is an expert in the field of architecture is needed (Indriyati, 2020). Chapter III Article 4 of Law of the Republic of Indonesia number 6 of 2017 concerning Architects, explains architect practice services in the form of the provision of professional services related to the implementation of architect

activities which include the preparation of preliminary architectural studies, the design of buildings and their environment, the preservation of buildings and their environment, the design of building layout and their environment, the preparation of technical planning documents; and/or supervision of architectural aspects in the implementation of building construction and its environment (Putra & Ekomadyo, 2022). In addition, architectural practice services can be carried out jointly with other professions. Furthermore, in Chapter III article 5 explains the architect's performance standards which explains that the Architect's Practice service must meet the Architect's performance standards which includes the architect's ability to provide design drawing documents apart from the plan document, calculation of the volume of documents, work plans and conditions and periodic supervision documents (Law of the Republic of Indonesia Number 6 of 2017, 2017).

In the past, drawing and designing techniques were done in a manual way which was done by pouring concepts or ideas first on blank paper and then after that it was scratched using pencils, rapids, and other equipment. (AlFajri & Nasution, 2016). Drawing manually is a difficult job and takes a long time because it has to be etched first before the drawing is approved because the drawing really cannot be changed after it is poured into drawing paper (Gerry, 2023).

For this reason, it is necessary to know how to make design drawing documents that are by standards and are more efficient in terms of time cost, and accuracy (Wasista et al., 2024). Currently, the architectural modeling program is a tool in architectural design that continues to develop along with the development of technology that can act as a drawing and design tool for architects where this modeling program is based on visual graphics and *Drafting.* (Karista, S, Fadhilah, & Wijayanto, 2022). Architectural modeling programs that are often used in making architectural design drawings are BIM, Autocad, and Sketch Up technology in order to help architects produce design drawings that meet standards from the design stage to the construction and construction stage so that it is more efficient in terms of time, cost and also produces more accurate image quality.

Method

The research method in the article entitled Utilization of BIM Technology, Autocad Software and Sketch Up in Architectural Design Drawings uses a qualitative descriptive method where this article describes architectural design drawings by utilizing BIM technology, Autocad Software, and Sketch Up.

Results and Discussion

Some of the architectural modeling programs that are often used in making architectural design drawings are as follows:

1. Autocad

Used for 2D and 3D drawing developed by *Autodesk.* Initially, Autocad was released in 1982 and was designed with simple software which was later developed in

1984 to develop 3D features. Until now autocad is the most popular software used by architects and teams to produce Design Drawing products.

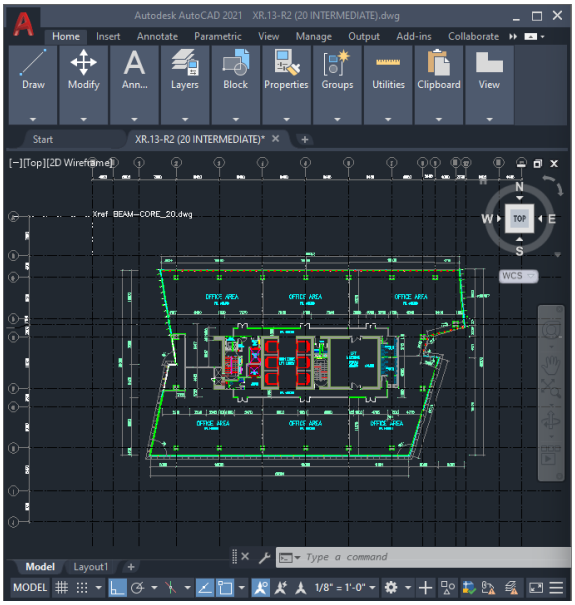

Figure 1
Drawing Plans using Autocad

But often in a Design Drawing, to continue to 3D *modeling* is more using *3D* Sketch *software* because its features are more complete than 3D by Autocad.

2. Sketch Up

Sketch Up is a 3D modeling program designed for architects (Bhirawa, 2021). This application is easier to use than 3D CAD programs. SketchUp has a feature called 3D Warehouse that allows SketchUp users to search for models created by others and contribute models. SketchUp was developed by the startup company @ Last Software, Boulder, Colorado which was formed in 1999. Sketch Up was first released in August 2000 as a general-purpose 3D content creation tool. The app won the Community Choice Award at an exhibition in 2000. The key to early success is a shorter learning period than other 3D tools. On March 14, 2006, Google acquired @Last Software, as Google was interested in creating a plugin for Google Earth. On January 9, 2007, SketchUp 6 was released, which featured new tools as well as a beta version of Google SketchUp Layout. Vector 2D Layout includes tools, as well as page layout tools intended to make it easier for paraprofessionals to create presentations without collaborating with third-party presentation programs. On February 9, 2007, an update was released. It corrects some bugs, but it doesn't bring any new features. On November 17, 2008, SketchUp 7 was launched, with its ease of use, integration of SketchUp's Browser Components with Google 3D Warehouse, and a dynamic 2-component layout that responded appropriately to scaling and improving the performance of the Ruby API. On April 27, 2006, Google announced Google SketchUp, a free downloadable version of SketchUp. This free version

differs from the Pro version of SketchUp, but it includes tools for uploading content to Google Earth and Google 3D Warehouse, a repository of models created in SketchUp.

Figure 2
3D Drawing Buildings using Sketch-Up

3. BIM

Building Information Modeling (BIM) is a process that involves the creation and management of digital information about the physical and functional characteristics of a building and is supported by various tools, technologies, and contracts. (Bhirawa, 2021). Building Information Modeling is a digital representation of the physical and functional characteristics of a facility. BIM can integrate structured and multidisciplinary data to produce a digital representation of a building throughout its lifecycle, from planning and design to construction. BIM is different from architectural drawing tools like AutoCAD, as it allows for the addition of further information (time, cost, manufacturer details, sustainability, maintenance information, etc.) into the building model. BIM also uses intelligent models that can be adapted to changes in design or specifications. BIM has many benefits for architects such as:

1) Improve design and construction quality by reducing errors, non-conformities, and change costs.
2) Increase efficiency and productivity by accelerating the design and construction process, as well as facilitating collaboration between various parties.
3) Improve the performance and sustainability of buildings by analyzing environmental and energy aspects, as well as monitoring the condition and maintenance of buildings.
4) Increase customer value and satisfaction by providing accurate and transparent information about buildings.

One of the BIM-based software that will be used to get more effective and efficient results is the Autodesk Revit software. (Muhamad Alimin, Imron Imron, & Muhammad Taulani, 2023).

In the use of Revit, the integration between 2D images and 3D models is very efficient as any changes made to one view will be automatically updated in all other views. For example, if there are revisions in a 2D plan drawing, the 3D model, cutouts, and elevation will automatically adjust without the need to manually redraw. This saves time and reduces the risk of errors, as each element that is changed only needs to be done

once and is instantly reflected throughout the project document. This efficiency makes the design and documentation process much faster and more accurate.

Accuracy in Revit is also higher because the calculation of volume, area, and amount of material can be done automatically through the *"Schedule Quantity" feature*. This eliminates the need to move data to Excel as it does in AutoCAD and SketchUp, reducing the risk of errors and speeding up the material estimation process directly from the model.

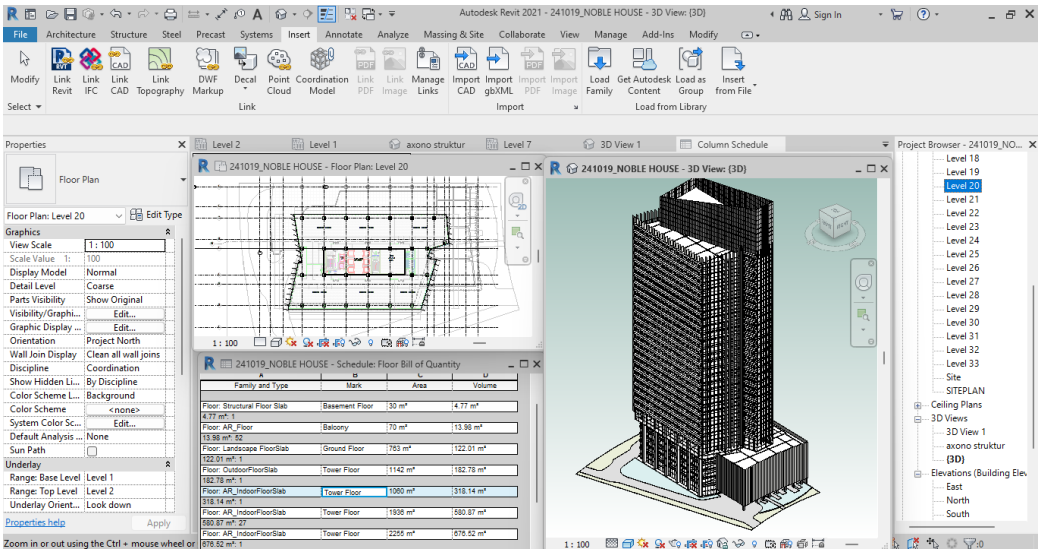

Figure 3
3D Drawing of Buildings using *Revit*

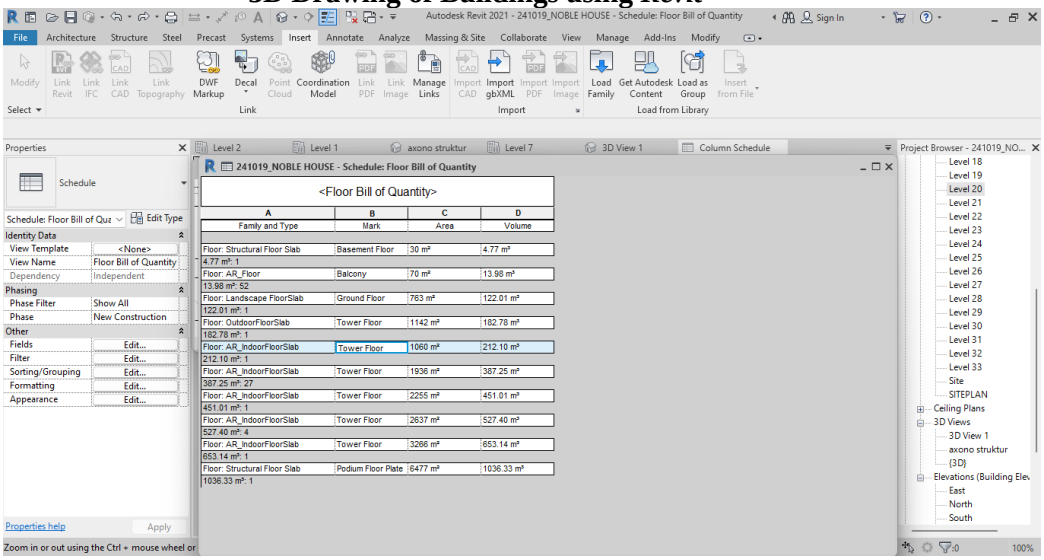

Figure 4
The floor of Bill Quantity on Revit

Visualizations in Revit can be set up with more advanced settings than SketchUp, allowing users to produce better 3D visualizations even if they have not yet reached the rendering stage. Revit offers a variety of options for adjusting lighting, materials, and perspectives, resulting in a more realistic and detailed view of the model without the need for full rendering. This makes it easier for designers to evaluate and improve design elements before moving into the final stage.

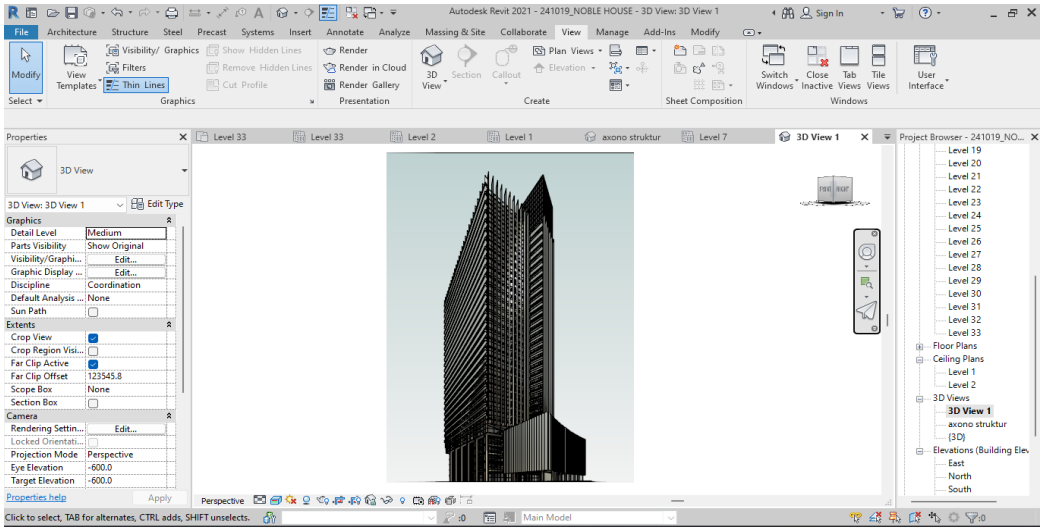

Figure 5
Visualization in Revit

Conclusion

From the explanation above, it can be concluded that the results show that the use of BIM technology, AutoCAD software, and sketch-up in architectural design can produce architectural design drawings more efficiently in terms of time, and cost and produce more accurate image quality.

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