Designing a building facility using GIS

Hameed Sarhan. Ismael

Geomatics Engineering division, Civil Engineering Department, University of Technology-Iraq

Email: 40131@uotechnology.edu.iq

Abstract. By using ArcGIS ArcMap and ArcScene software capabilities in building and facilities design to save the costs of errors that will happen in real establishment. GIS provides the ability to draw, import drawings and import information from other software, aerial images, satellite images & from hardcopies to add to the changes that happened and link it to the geographical coordinates system. All that in one or more geodatabase that provides full information to the user without the need of other software, or more hands to search for information in lesser time. This is what the International Livestock Research Institute (ILRI) has done to minimize the time and effort that is needed to find information. Easy to use by discovering the errors and finding a way to fix it. This procedure is most flexible for directly fixing and modifying things, such as incorrect length of the designed electricity wires, incorrect shape & height of walls & the errors in designing the sewer. We can use the data that already exists in another building, that has the same information instead of entering it from the beginning, this ability saves time and money.

Keywords
Image Processing, GIS, building design, facilities design

1. Introduction

In this paper, we used ArcGIS, which is a computer software that links geographic information with descriptive information [1]. GIS can present many layers of different information. OR it is a collection of computer hardware, software, and geographic data for capturing, storing, updating, manipulating, analyzing, and displaying all forms of geographically referenced information. This is a very general description for such a complex and wide ranging set of tools [2].

The ArcGIS platform can be used to build or enhance your facilities technology system. The ability of GIS to analyse and apply models based on different scenarios allows the facilities managers to create an efficient building from the start that provides the best space usage and energy efficiency possible. As the building matures, staff can model asset usage and depreciation over time and manage security and environmental costs. Most importantly, GIS opens up facilities-specific software and data for use across the enterprise [3].

2. Objective of work
The main objective of the work is to acquire the skill and experience to design building facilities, using ArcGIS software in drawing a building and its facilities (sewer & electricity) and making a virtual 3D model of the building to discover faults and reduce costs.

3. Importance of the work

Making a virtual 3D model of a building helps us see what it looks like before it is constructed and discover the defects and problems in design, which reduces the cost of modeling in the traditional ways.

4. Experimental work

4.1 Preface

In this work, a mechanism of drawing a building and its facilities using ArcGIS 10.4.1 software (ArcCatalog, ArcMap & ArcScene) is mentioned including creating shape file and the final stage, 3D model of the building with all the necessary requirements.

4.2 General Structure of work

The general structure of designing building facilities using ArcGIS software is represented by:

- Making & Adding shape files
- Drawing
- Input data
- Displaying to find errors & problems
- Final display

4.2.1 Making & Adding shape files. This stage is the first step in any drawing using geographic information systems, which is very important as all subsequent work using the program is based on it, by making new files to contain the work we have to use ArcCatalog to make a new shape file and it's done in two ways to do it, it's explained in ‘figure 1’. In this work, I used nine shape files, three for walls, three for floors, two for electricity & one for sewer. The use of three stories in this work doesn't mean that the software can't do more but it's enough for this work and the rooftop means that we can build more stories.

4.2.2 Drawing. After that, we start to draw the designed sewers in the shape file that we have designed by using six manholes at the size of 40*40 cm for the purpose of easy cleaning, three floor drain at the courts at the size of 4in., five gully-trap (one at the eastern toilet another one at the kitchen the third one in the laundry room & the last two at the bathroom), one Elbow 90 for the western toilet, two red 45 & all the pipe used is a 4in. diameter made of PVC.
Finally, we started drawing the electricity for the building, all the wire & cables of electricity are extended through a PVC pipes with 1in. diameter.

According to the design we started from the main switch at the wall of the garage then going by 4*16mm for the main switch of the ground floor in the living room then from the later starting to extend 3*2.5 mm wires for all the rooms in the ground and from these wires starting to foundress the electricity of the rooms.

**Figure 1. The Sewers**

**Figure 2. The electricity**

4.2.3 *Input data.* This step is a very important one for this work and for the 3D model. The data putted in this step effect the final shape and detail of the 3D model, the numbers that putted in the attribute tables represent the elevation and height of the polygons.
4.2.4 **Displaying to find errors & problems.** This step is necessary to find the final shape of the building and if there are any errors happened during the drawing or in inserting data, we apply this step by using ArcScene software by adding data the same way we did in ArcMap.

In the same way we display all the building parts and its facilities to see the final model. After we displayed all shape file I have found errors in the draw that I have forgot to draw a polygon and found error by interring the number that present the length of some wires.
4.2.5 Final display. After correcting the errors that happened in drawing and interring data the final result is in Figure below:

Figure 5. Display Facilities in 3D

Figure 6a final Display Facilities in 3D
5. Conclusion & Recommendation

5.1 Conclusion
Using the virtual design model for evaluating, assessment and analysis to discover the error and miss allayment Use the data that already excite in another building that similar to or have the same needs after putting some changes to it to fit for the new one.

5.2 Recommendation
Recommending to use this software because it give us wide options to optimize building design variable Expand the facilities serves like fire alarm serves, water supplies, air-conditioned net work

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