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Beijing Xidan Business Street Plan Evaluation

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Abstract

In the international cooperative research project of "Utilizing Three-Dimensional Data in a Virtual Urban Environment to Support and Evaluate Planning Decisions" in Beijing, a digital city is constructed, and a set of planning regulations is established. This paper will give you a brief introduction to the programming of evaluating the city planning with ObjectARX accompaning AutoCAD. By loading the application programmed in Visual C++ on AutoCAD software platform, you can design a building and let the tool evaluate the design to generate graphic suggestions.

Disciplines

Architectural Technology | Architecture | Urban, Community and Regional Planning

Comments

BEIJING XIDAN BUSINESS STREET PLAN EVALUATION

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Abstract. In the international cooperative research project of "Utilizing Three-Dimensional Data in a Virtual Urban Environment to Support and Evaluate Planning Decisions" in Beijing, a digital city is constructed, and a set of planning regulations is established. This paper will give you a brief introduction to the programming of evaluating the city planning with ObjectARX accompaning AutoCAD. By loading the application programmed in Visual C++ on AutoCAD software platform, you can design a building and let the tool evaluate the design to generate graphic suggestions.

1. Urban Planning and Evaluation Methods

Generally speaking, the activity of urban planning is a feasible design scheme of local ordinance consulted, future-oriented, combined with the interests of the public, groups and individuals (Zorica, 1999).

After the establishments of the street redline and properties redline by the urban planning government, you can design the buildings in the specified area. At this stage, the following factors must be taken into account: building height, building density, floor area ratio, green space ratio, and a setback space from the street redline a fireproof space from adjacent building, a sunshine space from adjacent building, as well as the parking place.

All such work is usually fulfilled interactively in AutoCAD: to draw, to calculate, and to checkout. It's fussy and fallibility.

With the help of the Visual C++ SDK tools, ObjectARX, supplied by the Autodesk Company, the author of this paper integrated the above design processes into one dialog command. Thus, the regulation data checkout and the plan evaluation are now easy clicks of dialogs and buttons; same easy tasks are the drawing of setback line, fireproof line and sunshine line.

2. Pretreatment of Urban Planning Drawing

For each block of street in the urban planning drawing, an outline and lot code (figure 1) must be set to distinguish it from others. The lot code is associated with the outline (a closed POLYLINE) in AutoCAD database as

extended data, or Xdata (Kurt 1994). And then, the ordinance data (table 1) can be obtained by searching the correspondent lot code in the regulation file.
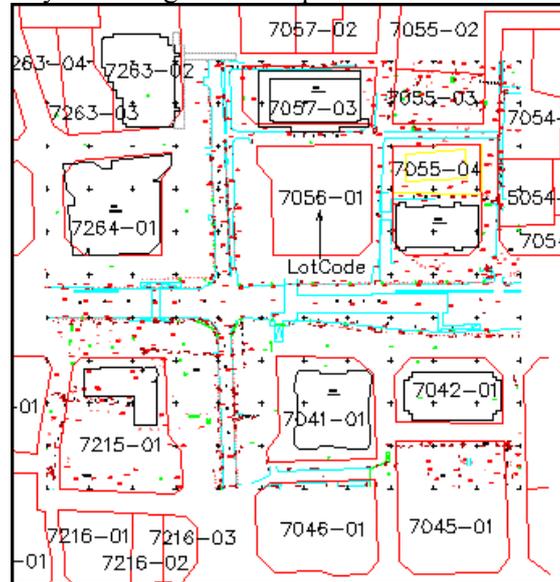

Figure 1. Outline and lot code of each block

TABLE 1. The ordinance data

LotCode	Bldg Type	Area (ha.)	Area Ratio	Coverage (%)	BldgHgt (m)	GreenSpace (%)
5054-07	C2	0.52	3.5	35	30	30
7041-01	C2	1.37	3.5	35	30	30
… …	…	…	…	…	…	…
7055-04	C3	1.34	3.0	35	45	35
7056-01	G1	1.54	-	-	-	-
7057-01	C2	1.61	3.5	35	30	30
7057-02	R5	0.38	1.2	40	9	35
7057-03	C2	1.02	3.5	35	30	30
… …	…	…	…	…	…	…

3. Implementation of Urban Planning and Evaluation Software

The first thing of implementation of the software is the geometric calculation method, and then is the programming.

3.1. GEOMETRIC CALCULATIONS

The problems to be solved by geometric calculations (Kalay, 1982; Joseph, 2005) mainly include: border line crossing, border line direction, determination of a point inside or outside a region, and the calculation of the centroid of the border line. In addition, the offset of varying distances from the original polygon (such as setback, sunshine, etc.), must also be treated.

3.2. IMPLEMENTATION OF PROGRAMMING

At first, create a class DialogMain, which inherits the class CAcUiDialog
supplied by ObjectARX(Lianghua, 2000):

```
#include <acui.h>          //CAcUiDialog Header File
#include "PlineStreet.h"    //Class of Street Redline Header File
#include "PlineProp.h"      //Class of Property Redline Header File
#include "PlineBldg.h"      //Class of Building Profileline Header File
……
class DialogMain : public CAcUiDialog
{
public:
  ……
  PlineStreet entStreet;         //Object of Street Redline
  PlineProp entProp;             //Object of Property Redline
  PlineBldg entBldg;             //Object of Building Profileline
  ……
  //{{AFX_DATA(DialogMain)
  enum { IDD = IDD_DIALOG_MAIN };
  ……
  CButton  m_ctrlButtonEntStreet; //Button to Select Street Redline
  CButton  m_ctrlButtonEntProp;   //Button to Select Property Redline
  CButton  m_ctrlButtonEntBldg;   //Button to Select Building Profileline
  CButton  m_ctrlButtonDataBldg; //Button of Building Data Dialog
  CButton  m_ctrlButtonDataRegu;//Button of Ordinance Data Dialog
  //}}AFX_DATA
  ……
}
```

The class include several buttons, to select street redline, property redline,
and building profile line, respectively. After all these polygons are selected,
the buttons of building data dialog and ordinance data dialog are activated
(figure 2).

Figure 2.   Main dialog

3.2.1. Building Data Dialog
In the building data dialog (figure 3), the parameters of the designing
building can be entered.

Figure 3. Building data dialog

3.2.2. Ordinance Data Dialog

In the ordinance data dialog (figure 4), the designing building can be checked and evaluated, and also, the setback lines, fireproof lines, and sunshine lines can be generated.

The controlling parameters of the ordinance is saved in the file regulation.txt, which includes the area code, the usage of the plot, the area of the plot, the building density of the plot, the area ratio and green space ratio of the plot, etc., to be opened and read by the program automatically when it is needed.

For example, when the button "Bldg height index" is clicked, the dialog "Check the building height" appears (figure 5), and the area code is figured out by the program according to the position of the building. Then, check the building height to the regulation data with the corresponding area code to see if it satisfies the rules.

Another examples is that, if the button "Sunshine index" is clicked, a profile fulfills the sunshine demands is drawn.

Figure 4. Ordinance data dialog

Figure 5. Check the building height dialog

4. Example of Executing the Program

Open a drawing file xidan.dwg in ACAD; Click the "Load Application..." command from the pull-down menu "Tools"; Select "BeijingCode.arx" in the dialog "Load/Unload Applications", then click "Load" button, load the ObjectARX program, then click "Close" button, close the dialog; Enter "Code" command from command lines, and a dialog "E-ordinances" appears (figure 2); Click the buttons to select street redline, property redline and building profile line respectively; Click the button "Ordinance data", and a dialog "Ordinance Data" emerges；Click the "Setback index" button, and a setback profile line is drawn (figure 6). The design is evaluated through ordinance data checking, and the graphic suggestions are generated by outlining the proper area satisfying the ordinance criteria. It shows you that any new building must be within the suggested polygon, and the height below it(in this case, the building is exceed the polygon, although the height is under the limit).
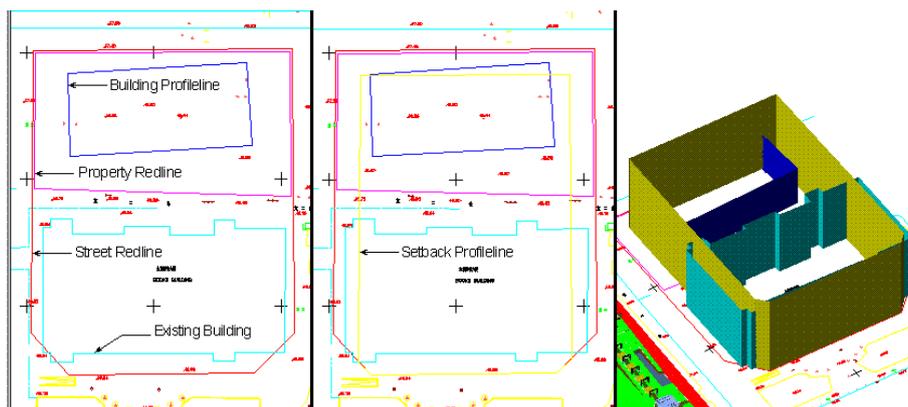

Figure 6. Setback profileline

Figure 7 shows another example of design with both the setback line and fireproof line generated. It is not exceed the suggested graphic range, but the coverage (47.828%) is over the regulation (35%). So, modifications of design are needed for both cases shown.
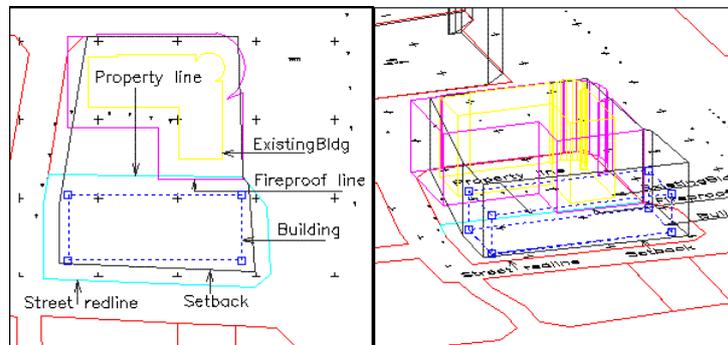
Figure 7. Setback profileline and fireproof line

5. Discussion

The paper presented a study of using the computer program to reduce the tedious tasks in the urban planning area. It is not perfect and only limited in Beijing Xidan, but the method is of common meaning. And by supplying the specific local regulation data, it can be used for other regions.

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