Research on AutoCAD secondary development and function expansion based on VBA technology

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Abstract. AutoCAD is the most widely used drawing tool among the similar design drawing products. In the process of drawing different types of design drawings of the same product, there are a lot of repetitive and single work contents. The traditional manual method uses a drawing software AutoCAD drawing graphics with low efficiency, high error rate and high input cost shortcomings and many more. In order to solve these problems, the design of the parametric drawing system of the hot-rolled I-beam (steel beam) cross-section is completed by using the VBA secondary development tool and the Access database software with large-capacity storage data, and the analysis of the functional extension of the plane drawing and the parametric drawing design in this paper. For the secondary development of AutoCAD functions, the system drawing work will be simplified and work efficiency also has been greatly improved. This introduction of parametric design of AutoCAD drawing system to promote the industrial mass production and related industries economic growth rate similar to the standard I-beam hot-rolled products.

1 Introduction

The design work of the industrial machinery industry is based on the drawing software of the major business. The most widely used in the drawing software is the AutoCAD software [1]. It not only provides users with a user friendly interface, powerful analytical capabilities and powerful pre-processing and post-processing functions, the operation is simple and easy to learn for the user's design graphics work provides a prerequisite guarantee. Nowadays, advanced industrialized productivity has become an important indicator of the design level of a country. The development of CAD technology in the direction of intelligent information technology is the inevitable trend of customization, specialization and integration of manufacturing industry.

AutoCAD provides an open architecture that allows users and developers to use advanced programming language to expand and modify it, that's the secondary development. VBA (Visual Basic for Application) [2] As one of the development tools is Microsoft's end user-oriented application programming language, to share memory with AutoCAD space and the development of the system program running faster. VBA developed by the program has a strong interactive capacity, easy to manipulate Windows resources, data management capabilities, easy to share data. VBA-based AutoCAD for the secondary development of the technology used [3]: ActiveX technology, ADO database connection technology, ActiveX Automation technology, which fully object-oriented programming advantages, so that the choice of language in the development of a great deal of flexibility, with VBA programming operations and control AutoCAD to achieve drawing function. ADO (ActiveX Data Objects) is an ActiveX data object, and a set of COM components provided by Microsoft. The automated programming interface based on object-oriented thinking that enables

applications to access and modifies a variety of simple, complex, or unqualified data sources, and is a bridge between AutoCAD and Access databases.

2   AutoCAD VBA secondary development parametric drawing system

Parametric drawing system [4] is based on the application of I-beam products, by introducing the parametric design idea in the design system to illustrate the specific process and the functional effect. It has a good reference for the similar system of AutoCAD to develop different products.

2.1 system design module

Each system design must first determine the function of its implementation, according to the design of the system function to divide modules. The I-parameter parametric drawing system is divided into three modules, including the program encryption module, parametric drawing module, data management module.

2.2 Introduction to module functions

(1) Program encryption module: the main user authentication function, the user can enter the correct password to enter the system to operate, for the parameter drawing module, data management module to provide security for database operations.

(2) Parametric drawing module: The system divides the parametric drawing module into two modules, interactively sets the parameter module and the drawing module. The main function of the interactive parameter module is to allow the user to enter the key parameters required to design the hot-rolled I-beam through the dialog box. The main function of the drawing module is to use VBA programming technology to retrieve the field name variable in the Access database to pass the parameter information to the VBA user to draw the form to realize the function of automatic drawing.

(3) Data management module: AutoCAD is in the hot-rolled I-graphics graphics field name in the VBA programming is defined as a variable, by retrieving the field name can be found in the database corresponding to the parameter data. In the Access database, set the field name and VBA in the same code, enter the standardized parameter data information storage, you can start the parametric drawing system to automatically call the data in the database information for the parametric drawing design module to provide data support. According to the user's key parameters, query the database table has been set the field name parameter values, and then assign the parameters to the variable, that is, to achieve the data call.
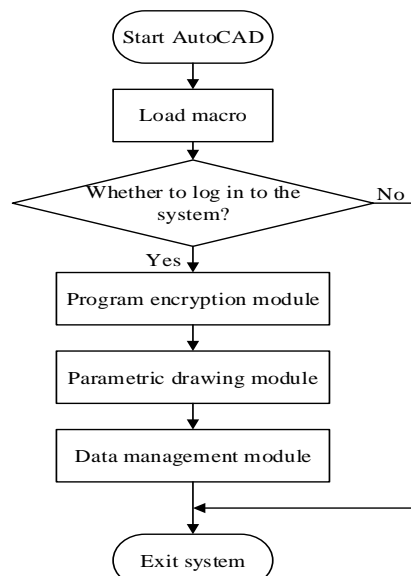
2.3 System design flow chart

Figure 1: system design flow chart

3 System implementation

3.1 system programming

(1) Determine the key parameter information of the drawn drawing, and extract the parameter definition variable for the convenience drawing system. The main parameters of the steel beam are height (h), leg width (b), waist thickness (d), average leg thickness (t), inner arc radius (r), leg radius (r1), the cross-sectional area S (area) and the theoretical quality W (weight) obtained by the calculation formula. In the Access database table, set the field name to facilitate the program index according to the variable [5]. Database Table 1 is as follows:

Table 1: Info Data Sheet

type	h	b	d	t	r	r1	area	weight
10	100	68	4.5	7.6	6.5	3.3	14.345	11.261
12.6	126	74	5	8.4	7	3.5	18.118	14.223
14	140	80	5.5	9.1	7.5	3.8	21.516	16.89
16	160	88	6	9.9	8	4	26.131	20.513
18	180	94	6.5	10.7	8.5	4.3	30.756	24.143
20a	200	100	7	11.4	9	4.5	35.578	27.929
20b	200	102	9	11.4	9	4.5	39.578	31.069

(2) Establish a connection to the Access database. Using the ADO technology, achieve data source connection of its object-oriented programming interface to. VBA programming first in the project reference ADO object library, the steps for the "Tools" - " Microsoft.Jet.OLEDB.4.0 ", part of the code as follows:

```
Set adoCon = New Connection
adoCon.CursorLocation = adUseClient
adoCon.Open.Provider="Microsoft.Jet.OLEDB.4.0;DataSource=E:\study\Data.mdb"
```

(3) Graphics drawing [6]. The main parameter information of the steel beam is obtained from step (1), which is designed as the main variable parameter in the interface, and the drawing function is realized according to the programmed drawing program [7]. Here are some examples of steel beam drawing function, as follows:

……
```
Dim ptBase(0 To 2) As Double
ptBase(0) = 0: ptBase(1) = 0: ptBase(2) = 0
Dim pt1(0 To 2) , pt4(0 To 2)As Double
Dim pt3, pt2 As Variant
pt1(0) = ptBase(0) + d / 2: pt1(1) = ptBase(0): pt1(2) = ptBase(2)
pt4(0) = ptBase(0) + b / 2 - r1 * (1 - Sin(Atn(1 / 6)))
pt4(1) = ptBase(1) + h / 2 - r1 * Cos(Atn(1 / 6))
pt4(2) = 0
……
Dim objPline As AcadLWPolyline
SetobjPline=ThisDrawing.ModelSpace.AddLightWeightPolyline(ptArr)
objPline.Closed = True
objPline.SetBulge 0, -Tan((2 * Atn(1) - Atn(1 / 6)) / 4)
objPline.SetBulge 2, Tan((2 * Atn(1) - Atn(1 / 6)) / 4)
objPline.SetBulge 4, Tan((2 * Atn(1) - Atn(1 / 6)) / 4)
objPline.SetBulge 6, -Tan((2 * Atn(1) - Atn(1 / 6)) / 4)
objPline.SetBulge 8, -Tan((2 * Atn(1) - Atn(1 / 6)) / 4)
objPline.SetBulge 10, Tan((2 * Atn(1) - Atn(1 / 6)) / 4)
objPline.SetBulge 12, Tan((2 * Atn(1) - Atn(1 / 6)) / 4)
objPline.SetBulge 14, -Tan((2 * Atn(1) - Atn(1 / 6)) / 4)
```

```
    ZoomExtents
    ……
Private Sub ExchangeData(ByVal bSave As Boolean)
    If bSave Then
        adoRs.Fields("h") = txtH.Text
        adoRs.Fields("b") = txtB.Text
        adoRs.Fields("d") = txtD.Text
        adoRs.Fields("t") = txtT.Text
        adoRs.Fields("r") = txtR.Text
        adoRs.Fields("r1") = txtR1.Text
        adoRs.Fields("area") = txtArea.Text
        adoRs.Fields("weight") = txtWeight.Text
    Else
        txtH.Text = adoRs.Fields("h")
        txtB.Text = adoRs.Fields("b")
        txtD.Text = adoRs.Fields("d")
        txtT.Text = adoRs.Fields("t")
        txtR.Text = adoRs.Fields("r")
        txtR1.Text = adoRs.Fields("r1")
        txtWeight.Text = adoRs.Fields("weight")
        txtArea.Text = adoRs.Fields("area")
    End If
End Sub
```

3.2 User interface design

The design of the user's interface system [8] is one of the important performances of the system. The convenient interface design can facilitate intelligent human-computer interaction and improve practical value. Among them, the user interface design is completed in the VBA editor.

(1) Hot rolled I-beam interface. The main function is to enable users to understand the characteristics of steel products during entering the system to operate interface at the first time.
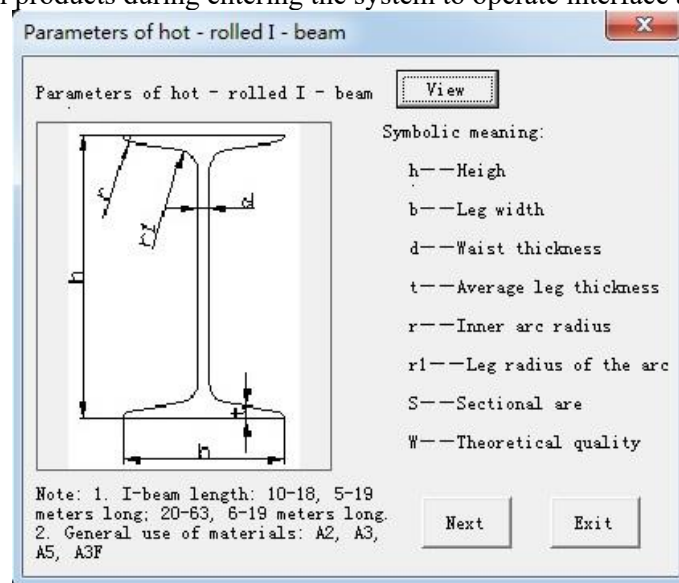

Figure 2: Parameters of hot-rolled I-beam

(2) Interactive dialog interface. The main function is the main parameters of the box with the corresponding parameters of the information after the model selection of the products, which can determine the drawing graphics. The function of the add model button in the interface is to add a new

model to the model list box. The function of the modify model button is the corresponding parameters for the need to modify the data can be used to achieve this button function after selecting the model. The function of remove model button is to delete the need to delete the model.
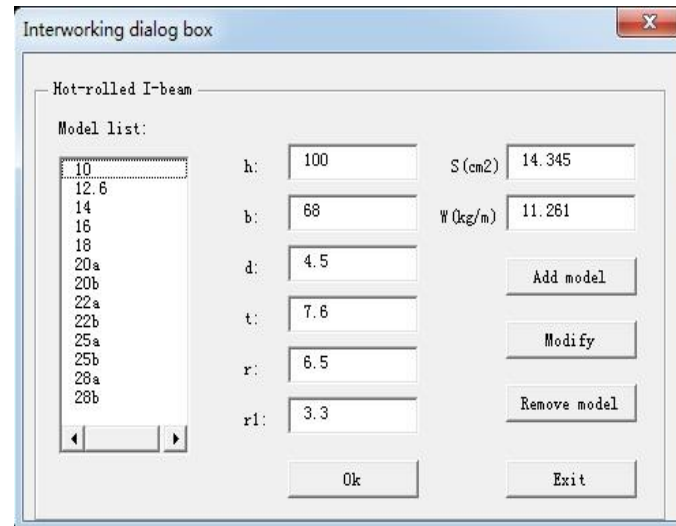

Figure 3: Interworking dialog box

3.3 Example renderings

The AutoCAD drawing interface can automatically draw different types of I-beam graphics after running the system program. It is as shown below:
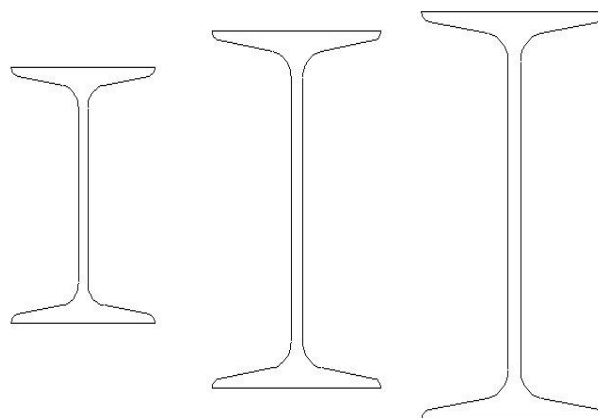

Figure 4: Draw different models

4 The expansion of AutoCAD secondary development

Due to the continuous development and advancement of technology, it is necessary to learn the function expansion after the AutoCAD secondary development of the parametric drawing system.

4.1 build three-dimensional model

It is an inevitable trend to build a 3D model based on the drawing of the system. However, the establishment of 3D model will make the whole design drawing function more perfect and intelligent for the drawing system.
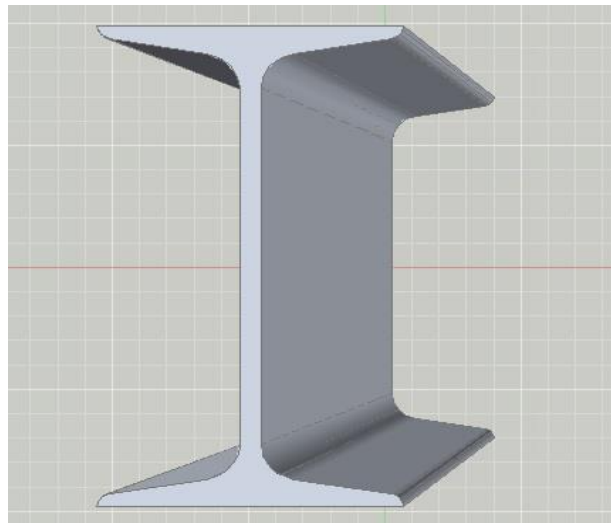
Figure 5: 3D model diagram

4.2 Customize the menu bar

The significance of creating the menu bar is the application of   the drawing system for the hot rolling I-beam, which   makes the system more convenient and intelligent. It   shows in Figure 6:
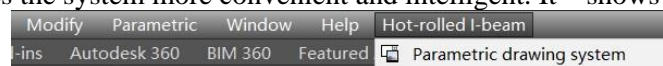

Figure 6: Customize the menu bar

4.3 Dimensioning

The annotation refers to increase the size to the graph, the geometry of the display object, the distance between the objects and the angle. Create a dimension with VBA programming. Which functions include AddDimRotated, AddDimAligned, AddDimAngular, AddDimRadial, AddDimDiametric, and AddDimOradinate. In this paper, the significance of the application of dimensioning is that can run the program on the I-shaped steel scale function when the design engineers need to draw the dimensions of the drawing. It is as follows:
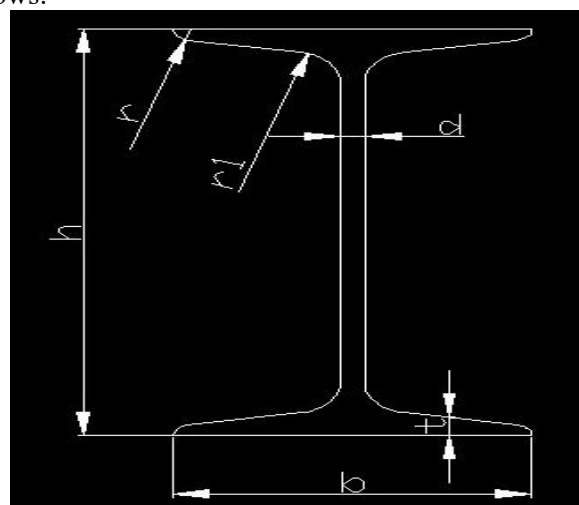

Figure 7: Dimension drawing

5 Conclusion

Through the analysis and development of the parametric drawing design system of I-beam, we can see:

(1) The parametric drawing system based on the AutoCAD secondary development technology of VBA can solve the problem of repeatability and error in the mass production of industrial products. Meanwhile, it also makes up for the defects of AutoCAD single drawing function and the standardization of hot rolling IWC production technology development has been further promoted. On this basis, the enumeration of several functions of the expansion: 3D model, custom menu bar, dimension and so on, which will also promote the future of the further development of parametric technology.

(2) At present, the parametric design generally refers to a bottom-up design method with the local to the whole. First, the designer must establish the relationship between the design parameters of the basic parameters of the algorithm by the design constraints into design data. the formation of parameters. Then select the appropriate parameters of the software design products will be the initial drawing graphics, with the help of parametric technology to carry out repeated scrutiny of the prototype to explore all the possibilities of the expansion. This approach greatly simplifies the design process of the product and it shorts the entire manufacturing cycles. Meanwhile, the parametric design development is approaching an important step in the concept of intelligent.

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