

# 1. Introduction

In recent years, with the rapid development of technology, computer technology has been used in our lives on a large scale, and computer graphics is one of the outstanding technologies [1]. The powerful capabilities of computer graphics have attracted more and more art designers to switch from traditional hand drawing to computer graphics design. Computer graphics offers people a broader design space, a richer design language and more robust design expression [2]. Therefore, this report will show the appeal of computer graphics by introducing a New Year's greeting card based on OpenGL.

## 2. Layout and Methodology

In this report, the New Year's greeting card layout will be explained in two parts: the general layout, the partial layout and its methodology.

### 2.1. The general layout

The general layout of this birthday card can be divided into three parts. The first part is the envelope, the second part is the cover of the card, and the third part is the body of the card.



Figure 1. The envelope and the cover

#### 2.1.1. The envelope

As shown in Figure 1. (a), the entire envelope is in a fresh style. It is surrounded by a red and blue frame, which looks very colourful among the whole envelope. In the top left corner of the envelope is the local postcode of Suzhou, while the bottom left corner contains the address and contact number of XJTLU. The stamp is affixed in the top right corner of the envelope, and in the bottom right corner is a picture of the window with a New Year's greeting at the bottom of the picture. The reason for designing the window and the greeting is that it is relaxing and brings good luck to people.

#### 2.1.2. The cover

Compared to the envelope, the cover of the card (shown in Figure 1. (b)) is not complicated. The gold colour chosen for the title in the centre and the frame around the cover makes the whole card brighter.

### 2.1.3. The card



(a)



(b)

Figure 2. The card

Firstly, to reflect the traditional Chinese New Year, the card has a red background, adding a sense of joy and warmth to the festival (shown in Figure 2. (a)). Secondly, to keep with Chinese tradition, the card's frame is designed similarly to Chinese knotting. Next, the plum blossom tree in the top left corner and the Chinese character called "fortune" in the top right corner are the most typical sights of the Chinese New Year. The plum blossom tree is designed to highlight the difference between the traditional Chinese New Year and the Western New Year. Finally, the bottom of the greeting card is accompanied by text and a candle, reflecting the nature of the traditional Chinese New Year.

## 2.2. The partial layout and its methodology

### 2.2.1. The envelope

Firstly, the frame around the envelope is formed using simple parallelograms. Secondly, the boxes in the top left and right corners are made up of lines, and their thickness is changed by the "glLineWidth" property of the lines. Thirdly, a function called "drawString" has been set up specifically in the program used for this report to draw text on the envelope. Moreover, a function named "setFont" is created in the program to support changing the font style. In this method, if a font is used, it needs to be deleted. Otherwise, "setFont" does not work even if the method is called correctly. Finally, the Bezier curve is used to draw the window in the bottom right corner of the envelope.

### 2.2.2. The cover

The cover is the easiest to draw among these sections, as it mainly serves as a reminder. The frame around the cover is drawn in straight lines. The middle text is used the same method employed in the envelope. Before entering the greeting card section, the cover also disappears with a special effect called "moving to the left", which employs translation transformation.

### 2.2.3. The card

Firstly, the frame is drawn using straight lines, but the position of each vertex must be calculated correctly. Secondly, to give the branches a curved shape, the Bezier curve is still needed here to simulate a realistic effect. Thirdly, the plum blossom is made by stitching together six same circles. This report combines the "for" loop with the "glVertex2f" function when drawing circles. However,

the project uses the polar coordinates method to represent circles rather than the traditional quadratic curve method. To save time and cost, the other identical plum blossoms are transformed by translation transformation after drawing one size of plum blossom. The following lanterns are also formed by translation transformation. The "fortune" character on the right uses the "OnTimer" function to achieve the spin effect. To achieve the rotation, the origin of coordinates needs to be moved to the geometric centre of the objects. Besides, the rotation angle must be set to a variable employed in the "OnTimer" function. Fifthly, the pentagram at the bottom of the card is made up of five triangles and one pentagon. The decorations near "Happy Chinese New Year" use the Bezier curve. Finally, the bodies of candles are implemented using "GL\_POLYGON". To make the candles more realistic, the ends of the candles are designed as rounded rectangles, composed of two circles and one rectangle. To achieve the "rounded" effect, the short side of the rectangle must be equal to the circle's diameter.

### 3. Instructions

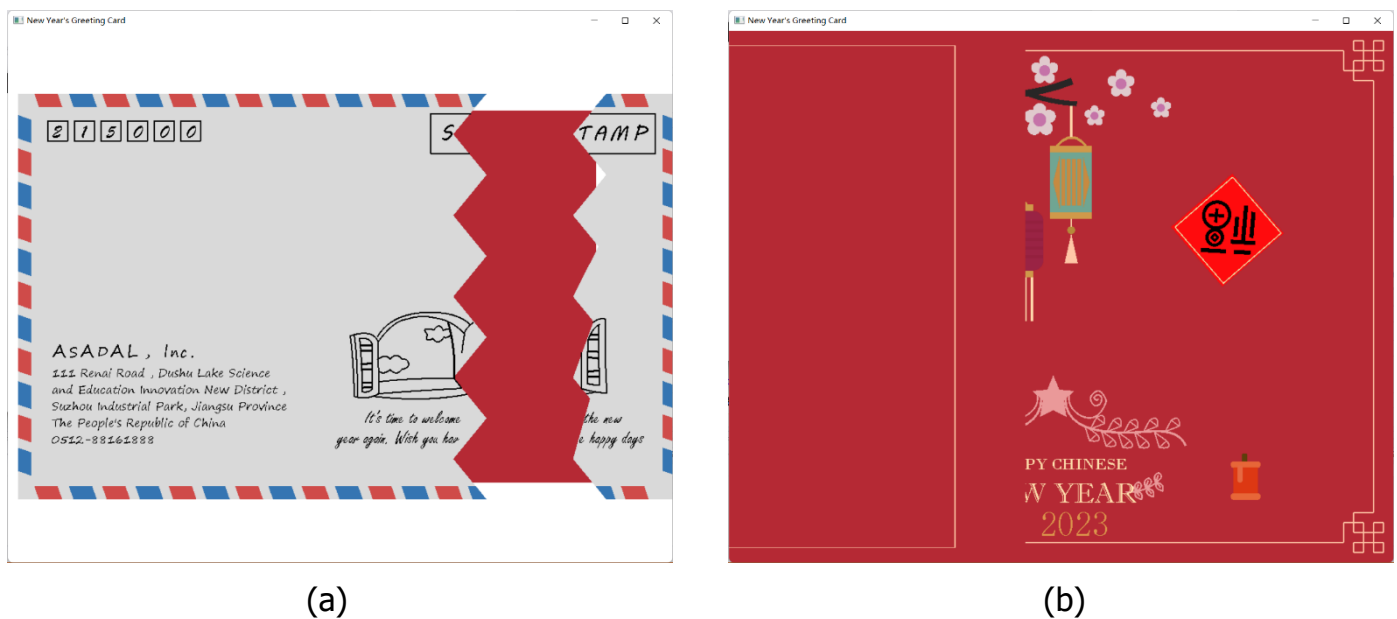


Figure 3. The instructions about the envelope and the cover

There are three instructions in this birthday card.

The first instruction is a mouse interaction (shown in Figure 3. (a)). When the program starts running, a rotation animation will be displayed. After waiting for the animation to finish, users can click the left mouse button. Next, a crack will appear in the envelope against the right-hand side, and the cover will be displayed. The cover will move to the right until it disappears, and then it will move from the right side to the left at a reduced speed. When the cover stops moving, it will be enlarged to the size of a window (shown in Figure 1. (b)). Once the animation of the cover has finished, users need to click the right mouse button, and then the cover will slowly move to the left until it disappears (shown in Figure 3. (b)).

The second instruction is the candles' keyboard operation. Initially, the New Year's greeting card stays in its original state (shown in Figure 4. (a)). Then, as soon as the user presses "L" or "l" on the keyboard, the match will appear from the right side of the window. After a certain period, both candles will be fully lit (shown in Figure 4. (b)). The candles will then move to the left side until they disappear (shown in Figure 4. (c)).

The third instruction is the exit operation. Users can exit the programme by pressing "Q" or "q" on the keyboard.

Moreover, it is essential to note that when performing these operations, people must wait for all the interactions containing animations until they have finished. Otherwise, the effect will not be as described in this report.

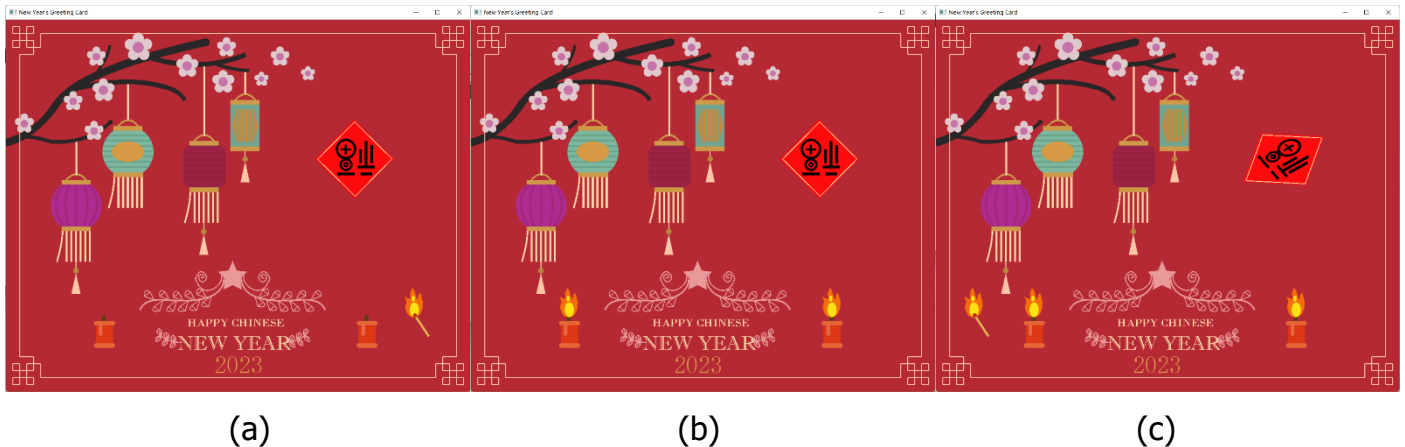


Figure 4. The instructions about the candles

## 4. Evaluation

Among all the elements, the interactive operation of the envelope is one of the most innovative designs. It uses an "OnTimer" function to act like opening an envelope in real life. Another innovative aspect is the layout of the New Year's greeting card. This card with Chinese elements naturally exudes a robust festive atmosphere.

However, there are still some problems with this New Year's greeting card code. For example, one of the problems is code redundancy. When using Bezier curves or drawing basic shapes, the vertices' coordinates need to be written, which takes up much space. Readers may feel discomfort in reading and understanding the code. Therefore, some optimised algorithms may be applied to the project, which can reduce the disturbance caused by the coordinates.

## 5. Conclusion

In conclusion, this report is based on the OpenGL library to implement a beautiful New Year's greeting card. Many methods of drawing graphics, such as pentagrams, circles and Bezier curves are applied to the project. In addition, disadvantages such as code redundancy still need to be addressed.

## 6. References

- [1] Y. Nie and Y. Qiu, "Discussion on the Application of Computer Drawing Software in Graphic Art Design," 2021 6th International Symposium on Computer and Information Processing Technology (ISCIPIT), 2021, pp. 239-242, doi: 10.1109/ISCIPIT53667.2021.00055.
- [2] Y. Yao, 'Research on the Application of Computer Graphics Software in Graphic Advertisement Design', J. Phys. Conf. Ser., vol. 1992, no. 2, p. 022024, Aug. 2021, doi: 10.1088/1742-6596/1992/2/022024.