CPT205 – Computer Graphics (2022-23)

Assessment 1 – 2D Modelling Project

Module code	CPT205
Module title	Computer Graphics
Name	Jing YIN
ID Number	2034355
Degree programme	Information and computing science

PART A - Brief description of the design

The two-dimensional New Year greeting card created this time is composed of branches, lanterns, flowers, pixel figures, greetings and golden borders. They are composed of geometric elements such as lines, ellipses, circles, quadrilaterals, polygons, text and so on. Therefore, techniques such as drawing lines, polygons, geometric transformations, keyboard interaction, mouse interaction, and drawing text are used. In order to present the full visual effect of the greeting card, you need to have keyboard and mouse interaction. Specifically, clicking the right mouse button to disappear the message and its text box will appear on the page. In addition, through the interaction with the keyboard, there will be a visual effect of petals rotating and falling and lanterns flashing colors.

PART B - Features of the Greeting Card

1.Geometric elements

Drawing polygons:
The shapes of flowers and lanterns all contain geometric elements-circles. For the cleanliness and convenience of the subsequent code (there is no need to write the same part of the code every time we draw), in the experimental code, the code for drawing circles is written separately. Name it circle. In the circle method, the "**glBegin(GL_POLYGON)**" technique is used.

Drawing Quadrilateral:
The pixel characters as well as the lanterns are made of quads. Hence, the "**glBegin(GL_QUADS)** " technique is used.

Drawing lines:
The tree branch, the gold thread under the lantern, and the gift box are all drawn in straight lines. Hence, the "**glBegin(GL_LINES)** " and "**glBegin(GL_LINE_STRIP)**" technique is used.

Drawing triangles:
When drawing the dialog box, the triangle element is applied. Therefore "**glBegin(GL_TRIANGLES)**" technique is used.

2.Geometric Transformations

Translation: In the card, there are 12 flowers with all the same elements except for position and size. In order to draw the flowers in different positions, the glTranslated method is called and is represented in the code as "**glTranslated(x, y, 0)**" which moves the current flower coordinates by x,y units in the x,y direction.

This method is also called for oval lanterns, square lanterns, etc. where most of the elements are the same.

Scaling: To draw flowers of different sizes, the glScaled method is called, represented in the code as "**glScaled(s, s, s)**", which means that the current drawing is scaled to s times its original size along the x,y,z axes respectively.
This method is also called for the gold line at the end of the lantern, etc.

Rotation： In order to achieve the result of flowers can rotate down, glRotated method is invoked. In addition, by adjusting the **glRotated** method of Angle parameters and using the keyboard interactive technology, realized the change the visual effect of petals rotate speed and direction of rotation.

3.Text

The greetings section is made up of text. Hence, "**selectFont(int size, int charset, const char* face)**" and "**drawString**" method is used. "selectFont" method decides texts format and size, "drawString" method decides texts contents.

4.Interactions using Mouse and Keyboard

Interactions using Keyboard：
The keyboard callback function "**keyboardCB(unsigned char key, int x, int y)**" is used in order to enable the keyboard to control the termination of program operation, the falling of the petals, the realization of returning to the branch after the petals fall down, the rotation of petals and the flashing of the lantern colours.

Interactions using Mouse：
The "happy new year" greeting and dialog box are not displayed on the screen initially. Displaying this part in the screen requires mouse interaction. Hence. a mouse callback function "**mouseCB(int button, int state, int x, int y)**" is used to receive mouse input.

5.Bezier Curves

The card is divided into two parts by a curve. The Curves were successfully drawn thanks to these techniques such as glVertex3fv(&ctrlpoints[i][0]), glViewport(0, 0, w, h), glMatrixMode(GL_PROJECTION), glLoadIdentity(), glFrustum(-1.0, 1.0, -1.0, 1.0, 1.5, 20.0), glMatrixMode(GL_MODELVIEW), glLoadIdentity(), gluLookAt(0, 0, 5, 0, 0, 0, 0, 1, 0).

6.Viewing

In order to perform a window-to-viewport conversion, that is, to convert the world coordinates into its own Cartesian coordinate system. glMatrixMode(GL_PROJECTION), glLoadIdentity(), glMatrixMode(GL_MODELVIEW), glLoadIdentity() techniques are used.

7.Animation

The flower's fall and rotation process is the embodiment of animation.

PART C - A brief instruction section

1.Interactions using Keyboard

The code is designed so that

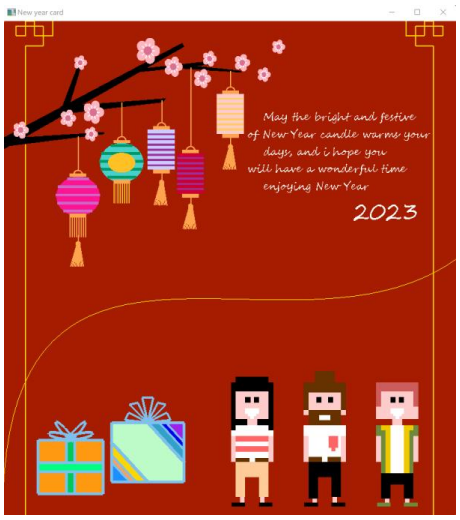
1. if **the q or Q key** is typed, the whole screen will pop up and disappear.
2. If **the s or S key** is typed, the petals will fall
3. if **s or S** is typed again, the petals will reset, i.e. return to the tree branch.
4. Additionally, if **the f or F is typed**, the direction of the flower's rotation will change.
5. And if **the m or M** is typed, the flower will stop rotating.
6. Type **r or R**, the flowers will spin faster.
7. **By typing l**, the colour state 1 of the lantern will change to colour state 2. Therefore, the lantern light flashing effect is achieved.

2.Interactions using Mouse

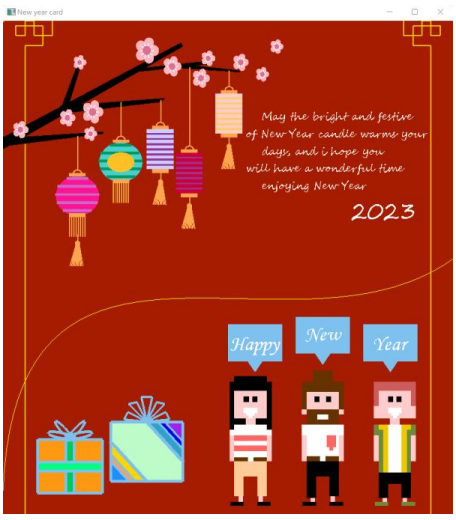
Specifically, press the **right** mouse button and the disappearing dialog box will return to the interface.

PART D - A set of typical screenshots

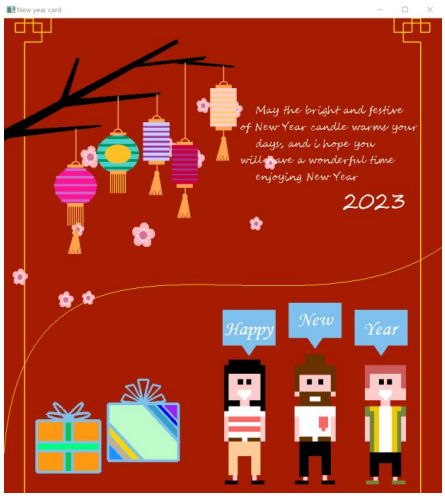
1.The initial screen



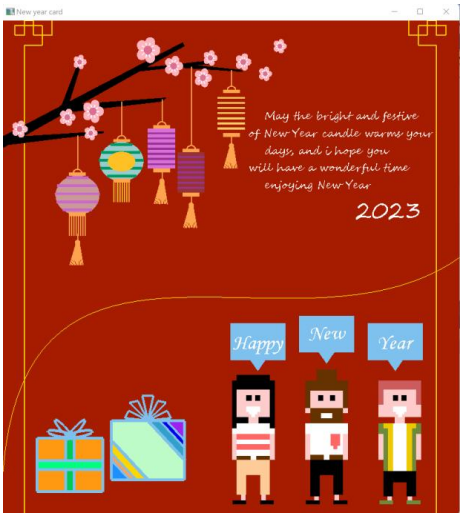
2.Interactive display of greetings through the mouse



4.Interactive display of flowers falling through the keyboard (The flower rotates to the right)



5.Switch lantern colors through keyboard



6. Interactive display of flowers falling through the keyboard (The flower rotates to the left)