Report

Assignment 1 : 3D Raster Model

Team members' details

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Working principle of codebase

First, we create a 10x10x10 grid and a solid cube of 1x1x1 inside it by enumerating the vertices of both grid and cube.

- To ensure that the cube's movements are aligned with the grid even after it is rotated, the cube should move along rotated axes and not the world coordinate axes. So, we captured the rotation of the grid, used this to rotate the axes of the cube, and then applied the required translation along the rotated axes.
- Inorder to restrict the cube's movement within the grid, we used the glm::clamp() function with appropriate boundary conditions. This ensures that when the cube meets the boundary of the grid, it stays in the same position.
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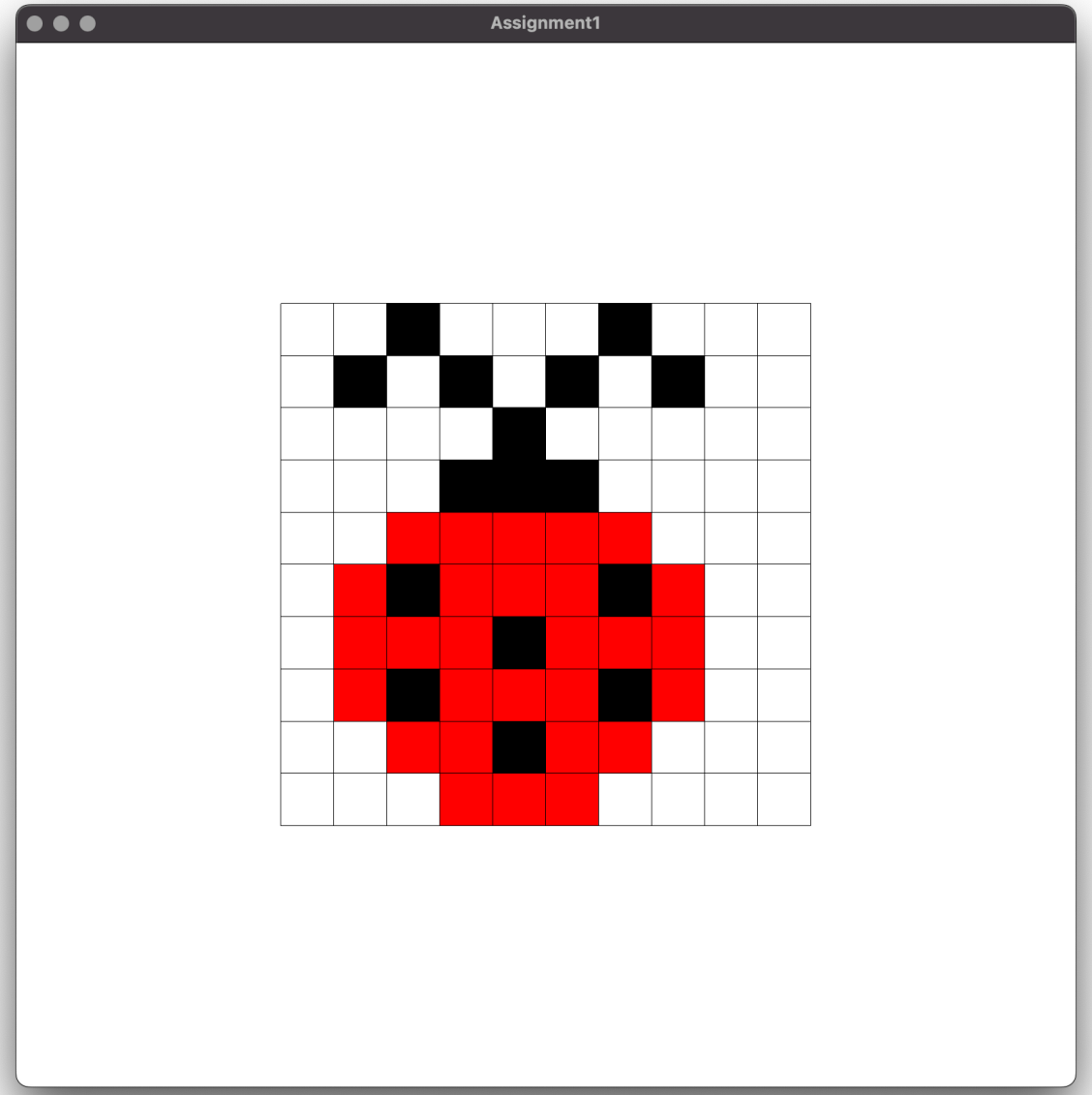
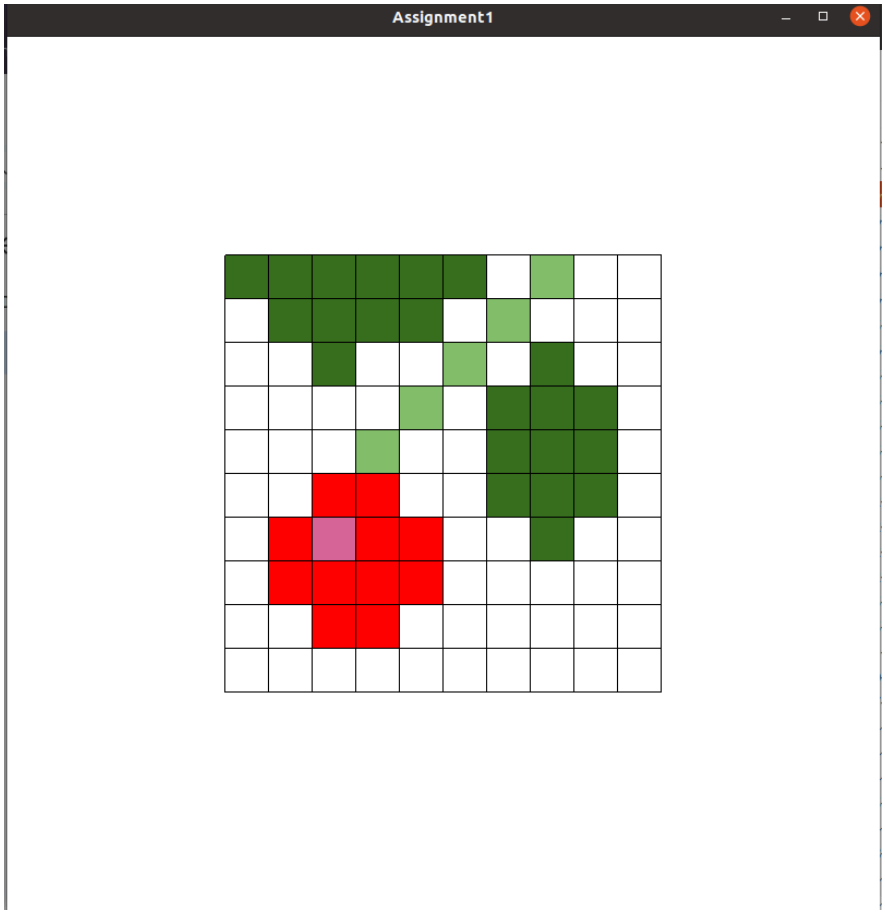
- The cube inside should rotate along with the grid. For this, we apply the rotation of the grid to the cube as well.

For changing color, 'C' should be pressed. This will take the user input from the terminal. The matrix which stores the value of the color values of the vertices of the cube is then updated and color data are reuploaded to the buffer to reflect the changes.

Screenshots of outputs

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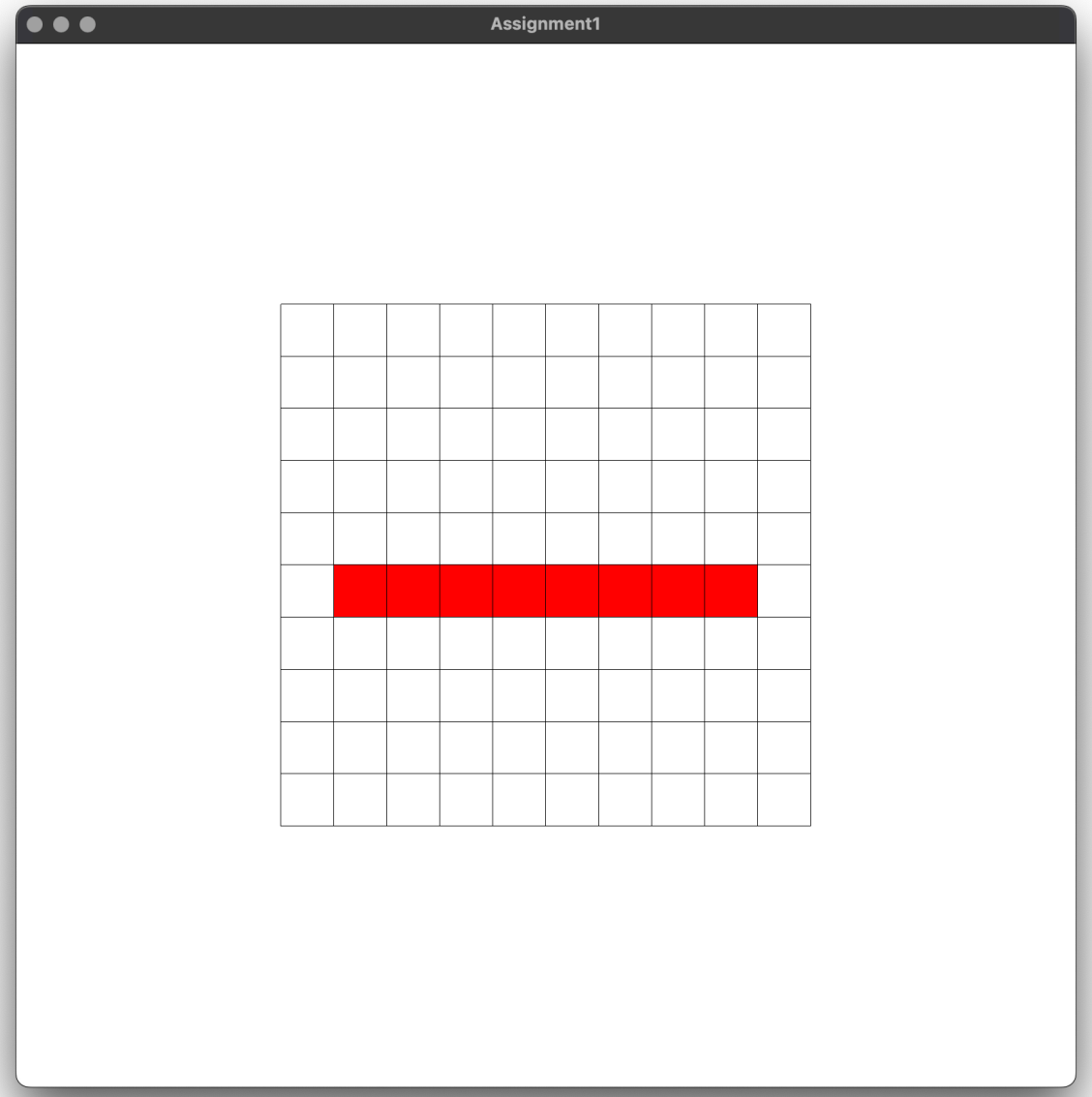

Implementation details

Key controls

For translation of the small cube, the following keys can be used :

- Left key - move the cube inside the grid from left to right
- Right key - move the cube inside the grid from right to left
- Up key - move the cube from bottom to top
- Down key - move the cube from top to bottom

- U -> move the cube from front to back
- B -> move the cube from back to front

For rotation of the grid, the following keys can be used:
- L -> rotate the grid from left to right
- T -> rotate the grid from top to bottom
- R -> rotate the grid from right to left
- D -> rotate the grid from bottom to top

To change the color of the movable cube, press C key.
To fix the color of a gridcell, move the cube to the grid cell and press F key
To remove the color of a colored gridcell, press W key.

Drawing grid

To draw the grid, we added the vertices of the grid iteratively to an array and then draw the lines to connect these vertices using *glDrawArrays* function.

Drawing the cube

To draw the cube we added the vertices of the cube to an array and iteratively added the indices of the vertices to an array and then drew the cube as solid triangles Using the element buffer object.

Translation of cube

The rotation of grid is recorded and stored in a matrix. The same rotation is applied to axis of cube and hence the cube rotates along the new axis. The translation is applied next and then that happens with respect to the new axis.
Rotation is done using the glm::rotate()
And translation using the glm::translate()

Rotation of grid

According to the key pressed the corresponding rotation angles are changed(incremented or decremented) and then the rotation is applied to the grid Model.

Change color of the cube

The key_callback function detects the key presses and if it's key C, in the terminal prompt we can enter the node number and color(RGB values) and its recorded using the standard input/output and then set to the cubes node.

Fill a cell of the grid and clearing a colored cell

The cubes positions,color are noted at that particular instant and a new cube is drawn, By storing the cube positions and their respective colour in an array and then the array is traversed and the particular copied cube is rendered. Later for clearing, the positions are checked and if they match the particular copied cubes position it is deleted from the array.

The color of the cube(which moves) is updated, by setting the isCube attribute in the shader to 1, and passing the color to vColor in the same way for the grid the isGrid is set to 1 and then the color of the grid is passed to the gridColor. For the color of the cell, the isCube, and isGrid is set to 0 and then the color to the cell is passed to the col(which holds the color of cells).