CS460 Fall 2022
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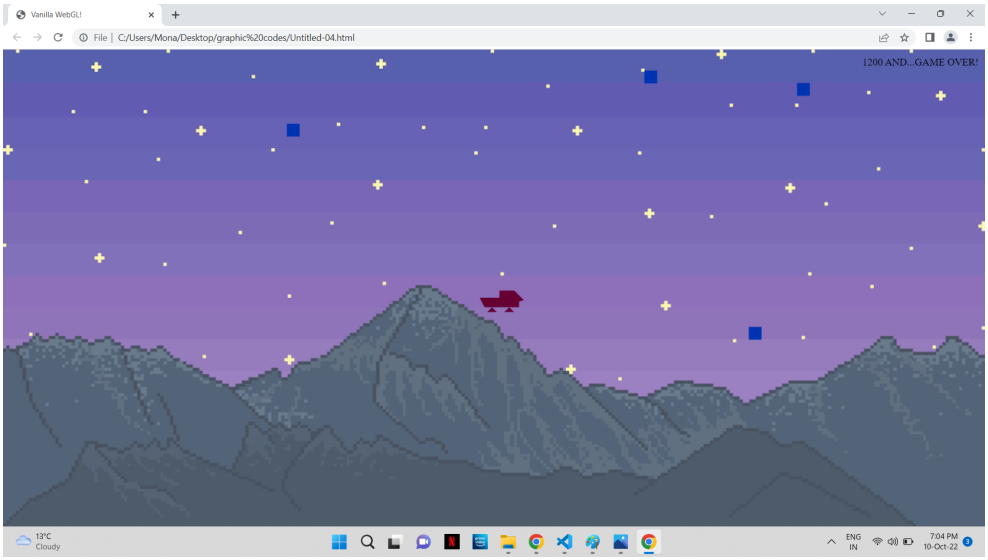
Assignment 4: A WebGL Game!

WebGL without a framework is hard. But this makes it even more rewarding when we create cool stuff!

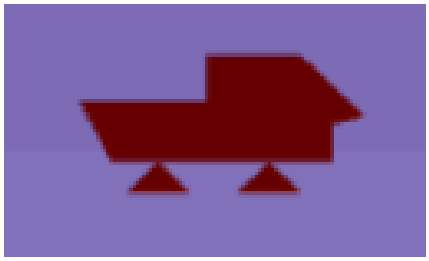
In class, we learned how to draw multiple objects (rectangles) with different properties (colors and offset). We also made the rectangles move! In this assignment, we will create a simple but fun video game based on the things we learned. In the game, the player can control an truck using the `UP,DOWN,LEFT,RIGHT` arrow keys in a scene to avoid obstacles. The longer the player can fly around without colliding with the obstacles, the more points are awarded. Once the player hits an obstacle, the game is over and the website can be reloaded to play again. The screenshot below shows the brown truck roughly in the center and multiple square obstacles in blue colors. The mountains, sky, and stars are a background image that is added via CSS.



Starter code: Please use the code from `https://cs460.org/shortcuts/16` and copy it to your fork as `04/index.html`.

Part 1 Coding: Extend the `createtruck` method. (25 points)

First, we need to create the truck . Take a look at the existing `createtruck` method. **This method needs to be extended.** We will use triangles to create a shape similar to the one pictured below. Please figure out the triangles we need and set the `vertices` array. We can assume that the center of the truck is `0,0,0` in viewport coordinates. Then, please setup the vertex buffer `v_buffer` (and remember create, bind, put data in, unbind). There is no need to change the `return` statement of the method. This returned array contains the name of the object, the vertex buffer, the vertices, an offset, a color, and the primitive type—the drawing code of the `animate` method needs this array in this exact order.



Part 2 Coding: Extend the `createObstacle` method. (25 points)

Now we will extend the `createObstacle` method. This method creates a single square obstacle. There are different ways of rendering a square but the simplest is to use a single vertex and the `gl.POINTS` primitive. Make sure that `gl_PointSize` is set appropriately in the vertex shader! We use `0,0,0` as our vertex and then control the position of the obstacle using the `offset` vector. Please modify the code to set the x and y offsets to random values between -1 and 1 (viewport coordinates). The color of an obstacle is already set to random and the `return` statement follows the same order as in Part 1. Once this method is complete, multiple obstacles should appear at random positions on the screen (9 in total as added to the `objects` array after linking the shaders).

Part 3 Explaining: Detect collisions using the `calculateBoundingBox` and `detectCollision` method. (20 points)

In class we learned about bounding boxes. The starter code includes collision detection using bounding box calculation of the airplane and the offset of an obstacle. Please study the existing `calculateBoundingBox` and `detectCollision` methods and describe how it works and when the collision detection is happening:

CALCULATEBOUNDINGBOX. This method is used to calculate the minimum sized box for the truck object which we created and also returns the minimum and maximum values of each dimensions x, y, z. Two parameters 'Vertices' and 'offset' are passed to this function. After that min and max values of x, y, z are initialized. The for loop in this function loops through each vertex that starts from the zero and creates the current vertex (i.e.vertex position + offset). Then compare all the current vertices of the truck with minimum and maximum values of dimensions x, y, z. Finally returns the list of min and max values of x, y, z which will creates the box for the object truck.

DETECTCOLLISION. This function is used to check whether the bounding box of the truck created using the function calculateboundingbox collide withe the obstacles or not. Initially the bbox and the point parameters are passed to the function. Then initialize the variable collision is false. By using the if conditional statements it checks all the six conditions before the collision returning true or else it returns false. That means if the obstacle found within the bounding box of the truck the the collision become true and it detects the collision.

Part 4 Coding: Extend the `window.onkeyup` callback. (20 point)

We want to allow the player to use the arrow keys to move the truck. Please take a look at the existing `window.onkeyup` method. The `if` statement checks which arrow key was pressed. Please extend this method to move the truck. Hint: Like in class, we just need to set the `step_x,step_y` values and the `direction_x,direction_y` based on which arrow key was pressed.

Part 5 Cleanup: Replace the screenshot above, activate Github pages, edit the URL below, and add this PDF to your repo. Then, send a pull request for assignment submission (or do the bonus first). (10 points)

Link to your assignment: `https://manasa-01.github.io/cs460student/`

Bonus (33 points):

Part 1 (11 points): Please add code to move the obstacles! Flying the truck around static obstacles is half the fun. The obstacles should really move! Please write code to move the obstacles every frame. The obstacles should just move in `x` direction from right to left to create a flying illusion for the truck. This can be done with little code by modifying the offsets accordingly at the right place!

Added code to move the obstacles in the main code.

Part 2 (11 points): Make the obstacles move faster the longer the game is played! Right now, the game is not very hard and a skilled driver can play it for a very long time. Currently, the scoreboard updates roughly every 5 seconds. What if we also increase the speed of the obstacles every 5 seconds? Please write code to do so. This can be done in one line-of-code!

Made the obstacles to move faster the longer the game is played.

Part 3 (11 points): Save resources with an indexed geometry! As discussed in class, an indexed geometry saves redundancy and reduces memory consumption. Please write code to introduce a `gl.ELEMENT_ARRAY_BUFFER` for the truck. Of course, we do not need to change anything for the obstacles since a single vertex does not need an index :).

Saved the resources with an indexed geometry by introducing the g1.ELEMENTARRAYBUFFER for the truck.