CPSC 3710 - Course Project

An Interactive Game using OpenGL

50 marks

Due: to be discussed in class

Project goal

In this project, you are required to design an interactive game using OpenGL. You are driving a robot through streets (with buildings) and explore them. During this process, you may also select some of the buildings and shoot them.

In addition to the OpenGL functionalities you have learned in class, you are further required to read some more samples posted on the course website and apply the techniques therein in this project.

Also please explore the OpenGL links posted on the course website. It would unrealistic for us to learn every single function in OpenGL in our lectures. Therefore this project will give you an opportunity to learn more about OpenGL.

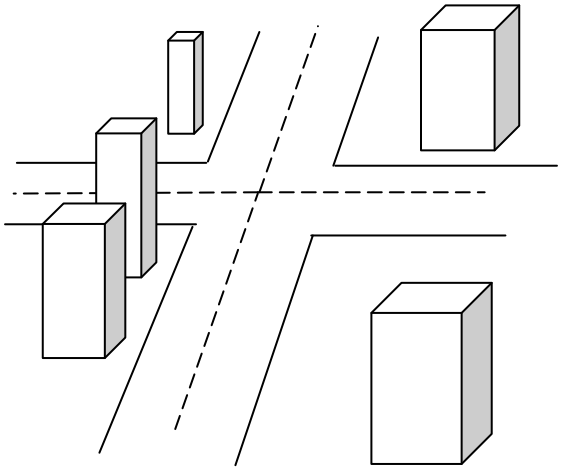
You can form a group of at most four students and every group member will be awarded the same mark.

Project details

(1) Streets

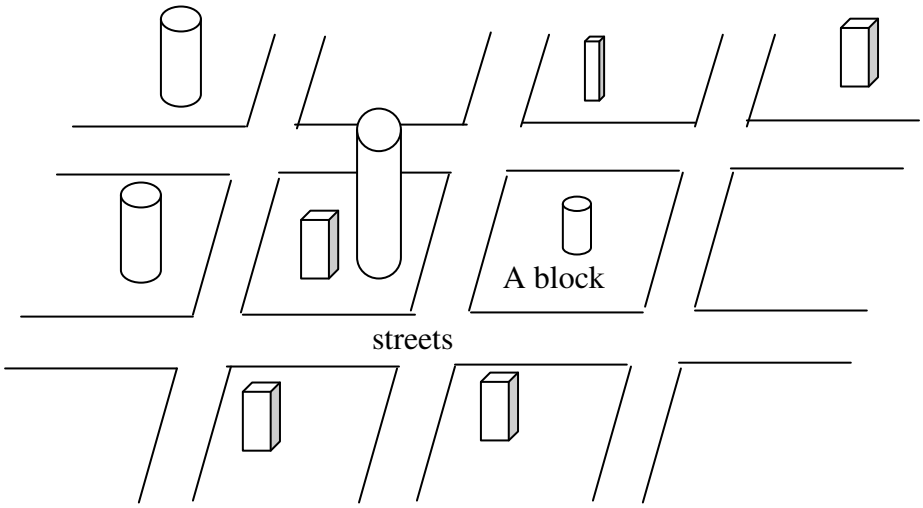
Look at the following picture for an illustration of streets. You may assume that the robot is walking on the xz-plane. All the streets are parallel with the x-axis or z-axis. Note that the following picture only shows a partial map. As your robot moves around, parts the map will appear/disappear.

You assume that the robot can only move on the middle lines (as indicated by the dotted lines) of the streets. It can move forward, turn left and turn right. However, turning left and right can only happen at the intersection of the dotted lines (this assumption makes the programming much easier).



All the streets should have the *same* width and you decide it *appropriately*.

(2) Buildings

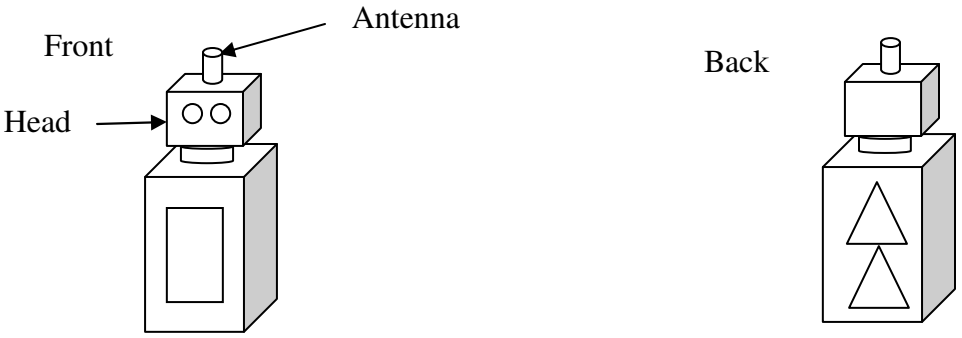


Imagine that your robot is exploring the downtown of the Manhattan area. The intersections of the streets form square blocks, as shown in the above picture. Again you decide a block's size *appropriately* and all the blocks should have the same size. There is a total of 20 x 20 blocks.

Within each block, randomly generate some buildings. Of course, a vivid building needs more efforts. But in this project, some prisms, cylinders, etc. should be fine. You can add windows to buildings but that is not required.

(3) The robot

Your robot has the following figure. Initially, the robot is at (0, 0, 0) and facing the negative z-axis.

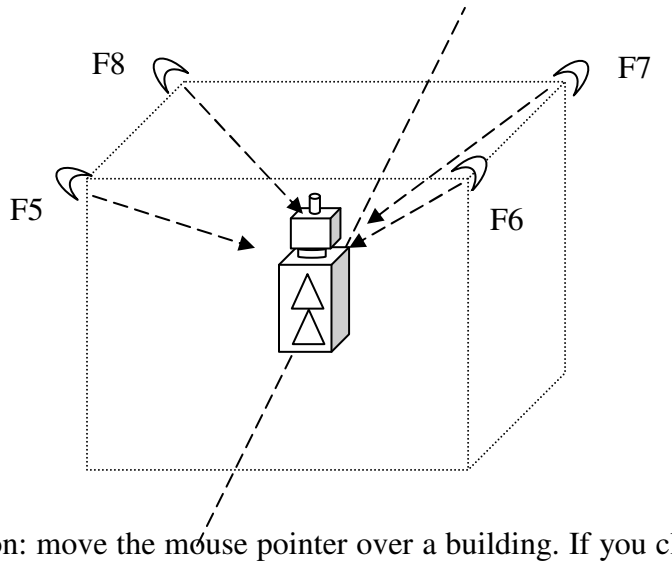


Your robot has two eyes and an antenna on its head. The antenna always rotates clockwise, with each step of 30^{o}. The robot's head can turn right, turn left or face forward. You decide the size of the each component in the robot and can add some extra components to make it look like the one in *Star Wars*. But the components in the above figure should be there.

Your LookAt view always follows the robot, i.e., the distance between your eye and the center of the robot is constant.

(4) Actions
The following is a list of actions that you can do.

(a) F1: turn the head of the robot to face forward. That is the default LookAt view.
(b) F2: turn the head of the robot to right.
(c) F3: turn the head of the robot to left.
(d) z: push the robot forward
(e) q: at an intersection of the streets, turn the robot to left. If the robot is not at any intersection, nothing happens.
(f) a: at an intersection of the streets, turn the robot to right. If the robot is not at any intersection, nothing happens.
(g) F5, F6, F7 and F8: install the LookAt view at the respective locations as shown in the following picture
(h) F4: returns the LookAt view to its default setting.



(i) Left mouse button: move the mouse pointer over a building. If you click the left mouse button, that building will disappear. Of course, if the mouse pointer is not on any building, nothing happens. Please see the tutorial posted on the course website on how to select an object in OpenGL.
(j) p: pause the game. Pressing p again continues the game.
(k) r: returns the robot to the origin if it is on the boundary of the exploration area you created.

Project assumptions

It would be unrealistic to design and implement a complete interactive game in a one-semester course. The following assumptions are made to make this project simpler.

(1) You decide the sizes and colors of different objects, including buildings, streets, blocks, etc.
(2) You can decide the number of buildings in one block, say 5, and fix it for every block.

(3) If a building is shot down, it disappears forever. Eventually, if you keep shooting buildings, all of them will disappear.

You can also make any other reasonable assumptions, and if so, should document them.

Project submission

(1) Design and implement a solution to the above project using C/C++.
(2) For your project, write a small tutorial (hardcopy) as how to compile and use it. Your marker will check it based on your tutorial.
(3) Write a summary (hardcopy and at most three pages) of your design and implementation, including
    (a) The distribution of work among group members, with their names and duties.
    (b) Any special data structures used in your implementation.
    (c) Any OpenGL you have learned during this project (not the ones we discussed in our lectures or posted tutorials).
    (d) Any assumptions of your own you have made in your project.
    (e) Any other documentation that you think may help understand your efforts.
(4) Submit your project (all the source code files, make file, etc.) in a CD such that the marker can check it.

Project hints

(1) Implement the shooting functionality at the last step.
(2) Decide the center of the robot and then add in the other components of the robot.

There might be necessary adjustments to the project, if needed, in the future.