

Homework VII

Assigned in Laboratory XI

Due in Laboratory XII

Please perform the following activities. This assignment is unpledged. You may work with one other person in your laboratory session. You are allowed to talk with others, but your work must be your own.

Objective

To become familiar the use of EzWindow bitmaps and to see how object-oriented design makes program modification easier.

Problem

The problem is roughly identical to that described in homework VI although some implementation details are different.

The Department of Energy (DOE) is in the process of developing a robot that can be used in hazardous environments. The robot, HERO (Hazardous Environment Robot Observer), is controlled by simple commands. HERO understands the following commands:

Command	Action
U or u	Move up
D or d	Move down
L or l	Move left
R or r	Move right
S or s n	Set speed to n
M or m n	Set movement distance to n tenths of a centimeter

When HERO executes a movement command (U, D, L, or R) it moves in that direction. It moves a distance that is specified by the last set movement distance command (M) executed. The speed command (S) tells HERO how fast to execute commands. The argument for the speed command is milliseconds. HERO delays n milliseconds before reading and executing the next command. Both the arguments to the speed and movement commands are integers.

To help DOE develop HERO, you have been asked to write a program that displays the actions of HERO. Your program reads a file of HERO commands and displays HERO's action in a display window. Since HERO's intended purpose is to find hazardous materials, the program should indicate when HERO encounters hazardous material. Whenever HERO crosses a region with hazardous material HERO should change colors.

A HERO command file has the following format:

```
20.0 20.0
9.0 9.0
0.0 0.0
S 100
M 10
D
D
D
D
D
D
D
L
```

This first line is the width and height in centimeters of the display window. The second line is the coordinates of the center of the hazardous waste region. **NOTE:** This a change from the previous assignment. There is **NO** length and width because we cannot control the size of the hazard region when it is represented using a bitmap. The third line is the starting coordinates of HERO. Following these three lines (which must be present in a HERO command file) are HERO commands.

Your program should open the command file `hero.dat`, create a display window of the indicated size, draw the hazardous waste region, and draw HERO at its starting coordinates. To represent HERO on the display use the robot bitmaps provided (see the Notes). The program should read HERO commands and update the display to simulate the movements of HERO. The program should terminate when the last command is executed.

When HERO enters the hazardous waste region, a red robot should be displayed. When HERO exits the hazardous waste region its color should be returned to normal.

If HERO attempts to move beyond the boundary of the left edge of the display window, HERO should appear at the right edge of the display window. Similarly, if HERO attempts to move beyond the boundary of the right edge of the display window, HERO should appear at the left edge of the display window. When HERO is at the top or bottom edge of the display window, the action is similar. If HERO attempts to move beyond the top edge of the display window, it should appear at the bottom of the display window. If HERO attempts to move beyond the bottom edge of the display window, it should appear at the top of the display window.

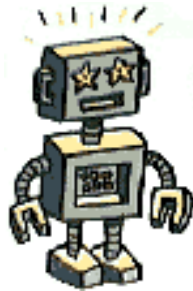
Revised implementation

For this assignment we want to use bitmaps to represent the robot and the hazard region. The hazard region will be represented by the bitmap contained in the file `hazard.bmp`. This bitmap file contains the image

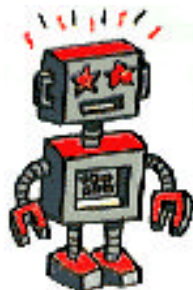


(which looks much better in color by the way).

When HERO is outside the hazardous region, the bitmap file `rbot-r.bmp` should be displayed. The image contained in this file is:



When HERO enters the hazardous waste region, the bitmap file `trbot-r.bmp` should be displayed. The image contained in this file is



Notes

The bitmap files can be obtained from the CS101 web page. Use the URL

<http://www.cs.virginia.edu/cs101/hw07>

and download the self-extracting archive `hw07.exe`. This file contains additional bitmaps. See the extra credit note below.

Please submit your program electronically before the beginning of Laboratory XII. You should submit five files. The files to submit are:

<code>robot.h</code>	Contains the class definition for the robot.
<code>robot.cpp</code>	Contains the implementation for the robot.
<code>hazard.h</code>	Contains the class definition for the hazardous waste region.
<code>hazard.cpp</code>	Contains the implementation for the hazardous waste region.
<code>hw07.cpp</code>	Contains the function <code>ApiMain()</code> and all other code needed to complete the assignment.

You should also turn in a hard copy (print out) of all five files at the beginning of your laboratory when the program is due.

See the 101 Web page for the grading criteria for this assignment. The URL is:

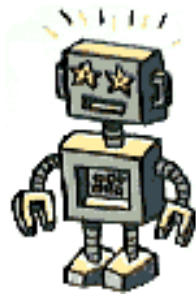
<http://www.cs.virginia.edu/cs101/>

Extra Credit

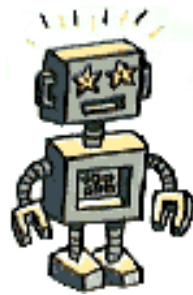
To make the simulation more realistic, display a bitmap that indicates the direction of the robot. The bitmaps are displayed below along with the file name that contains the image. The direction is indicated by the letter in the file



`rbot-d.bmp`



`rbot-l.bmp`



`rbot-r.bmp`



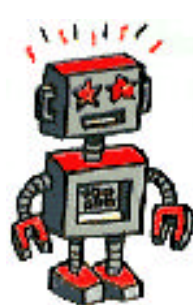
`rbot-u.bmp`



`trbot-d.bmp`



`trbot-l.bmp`



`trbot-r.bmp`



`trbot-u.bmp`

name. For example, the bitmap file `rbot-u.bmp` is the image to use if the robot is moving up. The extra credit portion is worth an additional 10 points.