Comp 110-003 - Assignment 9:

MVC and Animation

Date Assigned: Mon Nov 28, 2011

Completion Date: Mon Dec 7, 2011 (midnight)

In this assignment, you will strengthen your knowledge of the MVC programming paradigm and get practice with animations. As in the previous two assignments, you will continue to improve your structured object programming skills.

Start this assignment with all of your code from the previous assignment!

Part 1: Turning Rectangle, Oval, and Highway into observables

Extend your `Rectangle and Oval` classes from the previous assignments by making them an observable that follows the Java Beans observable pattern. There are three steps that you must do:

1) Define a `PropertyChangeListener` history
2) Implement the *standard* `addPropertyChangeListener` method in `AHighway`
3) After you change a value of one of the `Rectangle/Oval` properties, notify all observers

For help on completing these steps, read the "Variations in Observer/Observable Communication" section in the MVC chapter notes. You can find additional examples in the `AnAnimatingShuttleLocation` discussion in the Array chapter notes.

Recall that the object that is actually changed is the one that must notify the observers. For example, when a car location is modified, it should be `Rectangle` and `Oval` instances making up the car that notify observers.

You do not have to implement `PropertyChangeEvent` and `PropertyChangeListener`. Instead, you can need to import them from the `java.beans` package. To do so, include the following two lines in every class that uses `PropertyChangeEvent` and `PropertyChangeListener` instances:

```
import java.beans.PropertyChangeListener;
import java.beans.PropertyChangeEvent;
```

Part 2: Moving the rabbit in all directions

Extend your `AHighway` by adding a `moveRabbitLeft`, `moveRabbitRight`, `moveRabbitUp`, and `moveRabbitDown` operations, which move the rabbit left, right, up, and down, respectively, by RabbitMoveDistance (defined in previous assignment). This should not take long because you have already defined `moveRabbit` in the previous assignment, which moved the rabbit vertically by MoveRabbitDistance. As was the case with `moveRabbit` in the previous assignment, each one of the new move operations must also check if the rabbit is colliding with any of the cars and update the RabbitStatus property accordingly.

If in the previous assignment, you moved the cars or the rabbit whenever the corresponding move distance properties changed, you will have to correct your assignment. The rabbit and the cars need to move when you or a user (which can be another object) calls `moveAllCar` or `moveRabbit`(`Left/Right/Up/Down`).

Also, if in the previous assignment, you used the move distance property values as offsets, you will need to correct your assignment. These properties stored by how much the cars and the rabbit should move, not to what location they should move.

Part 3: AConsoleHighwayController

Implement a console-based controller for `AHighway`, called `AConsoleHighwayController`. It should implement the following interface:

```
public interface HighwayController {
      public void setModel(Highway  model);
      public void processInput();
}
```

The `processInput` command accepts user input from the console. Assume the user can enter the following commands only (hence, no erroneous input checking is required):

1) 'a' to move the rabbit left
2) 'd' to move the rabbit right
3) 'w' to move the rabbit up
4) 's' to move the rabbit down
5) 'q' to stop entering commands

Each command must be followed by Enter. This is a somewhat awkward input interface, but it makes the code you have to write a little less complex. So to move the rabbit up twice, the user would type first w, then Enter, then w again, and then Enter again.

Part 4: Animating AHighway

Define two editable integer properties, AnimationDistance and AnimationPause, in `AHighway`. Then implement a `startGame` operation in `AHighway` that has an infinite loop that does the following:

1) Move the cars by AnimationStepSize to the left
2) Sleep for AnimationPauseTime time

*NOTE: After a while, all of the cars on the highway will move off the screen. This behavior is **acceptable**.*

Part 5: AHighwayDriver

Implement your main method in `AHigwayDriver`. The method is responsible for:

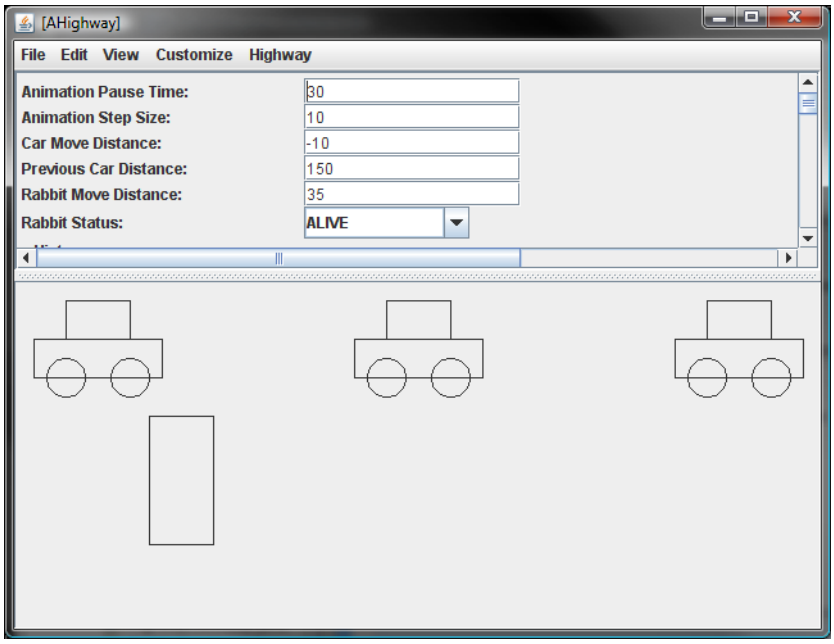
1) instantiating `AHighway` (the model)
2) instantiating `AConsoleBasedHighwayController` (the controller)
3) Connecting the model and the controller
4) Calling `bus.uigen.ObjectEdtitor.edit` to display the highway

`AHighwayDriver` also sets up the highway for the game as follows:

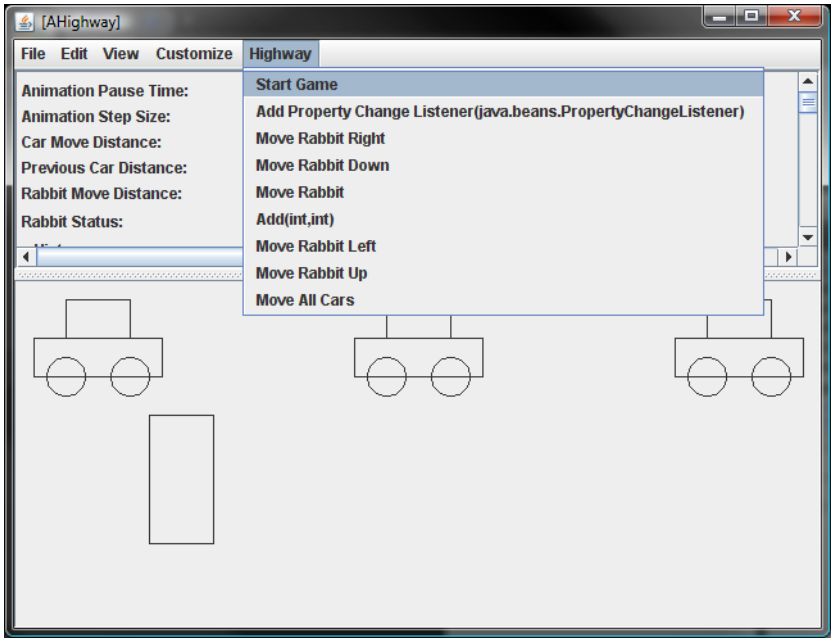
1) Sets MoveCarDistance to 10
2) Sets PreviousCarDistance to 150
3) Sets MoveRabbitDistance to 35
4) Sets AnimationStepSize to 10
5) Sets AnimationPauseTime to 30
6) Adds 30 cars to the highway, each of which is of width 100 and height 30

Playing the Game

1) The user first runs `AHighwayDriver`. The following screen should appear.



2) Once the highway is displayed in an ObjectEditor window, the user invokes the `StartGame` operation on the Highway as shown below.



3) Then the user enters commands to move the rabbit.

Finishing the Game

There are two ways to finish the game.

1) Rabbit crosses the road without getting hit: In this case, you need to display a "Congratulations! You live to play another day" message in a `JOptionPane`.
2) Rabbit gets hit: In this case, you need to display a "Splat! Please try again" message in a `JOptionPane`.

When a finishing condition is reached, you do not have to stop the cars from moving. The reason for the latter is that in the real-world, cars on a highway will not stop because of a rabbit. Also, assume that the user will not enter any more commands once the finish message is displayed. In other words, you do not have to write any code to explicitly prevent the user from entering anything but a non 'q' command.

Bonus

For the past few months, the bunny world has been hopping. A rumor has been spreading that the legend of Bravehops will be fulfilled on Dec 5, 2007. For those of you who have not heard of Bravehops, it is a legend of a rabbit who escapes the Land Below the Highway and reaches the world beyond. Rabbits from the farthest reaches of the Land Below the Highway have gathered in the grassy area just inside the border of their world in anticipation of the fulfillment of the legend. If Bravehops manages to reach the other side, they will all stand up and clap their ears. But if Bravehops does not reach the other side, they will quietly leave without ever being seen.

Your bonus, should you choose to complete it, is to draw the spectators once Bravehops crosses the highway. The number of spectators you need to draw the n^{th} number in the Fibonacci sequence. The value of n is stored in an editable integer property of `AHighway`, called FibonacciNumber. You must use recursion to calculate the number of spectators from the FibonacciNumber value. The n^{th} number in the Fibonacci sequence is calculated as follows:

$$F(1) = 1 \qquad \text{if } n = 1$$

$$F(2) = 1 \qquad \text{if } n = 2$$

$$F(n) = F(n-1) + F(n-2) \qquad \text{if } n > 2$$

While the exact locations of and the separation between the spectators is not important, an outside observer should be able to count the exact number of spectators. In other words, don't draw them all in the same location because it will appear to an outside observer that there is only one spectator regardless of how many you actually draw.