CSE251: Graphics - Spring 2014:

Assignment 2: The Fossil Park Ride

Due Dates. **Intermediate:** Saturday, Feb 8th, 11pm; **Final:** Monday, Feb 17th, 11pm.

1 The Problem

This time, we move on to a 3D world. The world consists of a rocky fossil park through which a stream is flowing. The rocky land contains lots of hills and valleys, and one of the valleys carry the stream. The player will be riding a motorbike through this park and the goal is to collect as many fossils as possible within a given time limit. One can do a jump with the motorcycle if they go over a peak above a minimum speed. The ride should be subject to laws of motion and gravity. To collect a fossil, we just need to ride close by it.

During the ride, you should allow the action to be viewed from multiple positions, which is controllable from the keyboard/mouse. The assignment submission is divided into two parts. The first part (2.1) includes creating a basic moving motorbike and rider with limited camera views and a simple world. The bike should be subject to laws of gravity and motion. Part-2 (2.2) will be the final submission, which will include the complete park, the stream, the ability to jump and all camera views.

The requirements mentioned below is the minimum set. It is recommended that you include additional objects/elements in the world according to your imagination and ability.

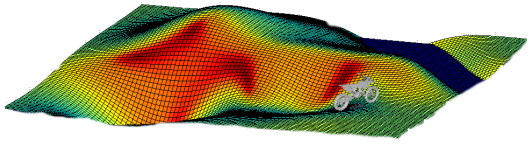

Figure 1: Mock-up of a sample world with missing tiles and the start and end positions of the person.

2 The 3D World

The world consists of a square rocky park with mounts and valleys of different heights and depths (see Fig. 2 for a small example. The mesh and color on the ground has been added to make shape of the surface clear to you and is not part of the). The motorbike starts at a random point and can ride along the rocky surface.

The riding is controlled by the following aspects: The speed, the tilt of the bike, the surface normal and the handlebar position (or radius of curvature of the turn). The speed and radius of curvature together generates the inertial (or centrifugal) force, which generates the outward torque and the tilt provides the inward torque. If they balance (approximately), the bike stays in balance (see Fig. 2). You may assume the frictional force is sufficient at any point.

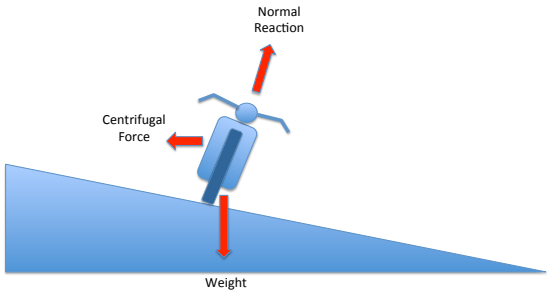

Figure 2: Forces to be considered for balancing the bike.

The second aspect of physics that applies to the ride is whether the bike stays on ground or not. This depends on the momentum of the bike and the gravitational force. The bike may jump over humps if the momentum is sufficient to overcome the gravitational pull, and then it follows the trajectory of a projectile, until it lands.

The motorbike consists of a rigid frame, a handle section that can turn left or right by up to 45 degrees and

two wheels of same size that rotates. You may or may not model the rider sitting on the bike. You can control the speed, the handlebar direction, and the tilt from the keyboard. The bike can move anywhere on the terrain and you can view the action from different points of view as described below.

The terrain is scattered with a number of fossils/treasures that you need to collect by riding close by them. If you lose your balance and fall, you lose all the fossils collected till that point. You need to collect as many fossils as possible before the time runs out.

3 Controls and Camera

The left and right arrows are used to control the tilt of the motorbike and the up and down arrows control the speed. The **a** and **d** keys are used to turn the handlebar left and right respectively. When the tilt of the bike is changed, you may turn the handlebar slightly to help balance. Note that this by itself is not sufficient to balance as the outward torque also depends on the speed.

The camera views are defined below:

1. *Driver View:* View from the drivers head position, where one can see part of the handlebar and the view to the front.
2. Wheel View: The camera is attached to the front wheel mud guard, and turning with the wheel (not spinning with the wheel, but only turning with the wheel while steering).
3. Overhead View: Camera is above the motorbike at a fixed distance always. The camera should see the bike and some of the world in front of it.
4. Helicopter Cam: Here the camera is movable with the mouse in an intuitive manner. Click and drag should change the look angle, up vector is always up, and scroll wheel will move the camera close or away from the scene.
5. Follow Cam: A view from the bike height, but at a distance behind the bike so that you can see both the terrain and the bike as it rides along.

Note that one should be able to switch views, and then control the bike as per their wish.

4 Optional

Feel free to include additional objects, animations, textures, etc. to make the world more realistic and rich. You may add more complex features to the terrain which the rider needs to navigate. Additional interesting camera views may also be provided.

5 Submission

You submissions should include your source code, a makefile and a compiled executable. You need to include a readme file that describes any additional information that is needed in compiling/executing you code. Do not use any non-standard libraries.

The submission will be in two stages: The first, due on the 8th should contain at least a box like bike (wheels and handlebars are not necessary) with at least the first three camera positions working and controllable from the keyboard. The world should contain at least a simple mound and stream with a few fossils. You are welcome and advised to do more by this deadline.

The final submission, on Feb. 17th, should contain the steering wheel and the car wheels with the corresponding controls and movement, the rotating search light, the remaining camera views, the complete world with texture and any optional items you may choose to add.

6 Grading

You will be graded based on the correctness, modularity, and efficiency of the implementation of the minimum elements described above. This will contribute to 90% of your grade. Remaining 10% will be given based on the improvements that you do over the basic world. In addition, submissions that are found to be exceptional by the graders, will be showcased, and will be awarded extra credits up to 10%.

30% of the grades will be based on the submission on the 8th and the remaining 70%, based on the final submission.