CHAPTER 6

Working with the Accelerometer

An accelerometer has many practical uses for applications that depend on the movement of a Windows Phone in three-dimensional space. With data from an accelerometer, you can steer a simulated car in a driving game or fly a plane in a flight simulator. You can capture motion such as a shake, punch, swing, or slash and mix this accelerometer data with a physics engine to create Wii-like games. Just for fun, you can build novelty applications to amaze your friends, such as a light saber simulation that makes Star Wars sounds as you swing your phone in the air. An accelerometer can even be used for business applications, such as a level for hanging a picture frame. Under the covers, the controller devices for games that run on consoles, such as the Wii controller, are nothing more than accelerometers wrapped in buttons and plastic.

The accelerometer in a Windows Phone measures the device’s movements in space, or more precisely, its acceleration along three axes (x, y, and z) relative to the earth’s gravitational pull (9.8 m/sec²), which is perpendicular to the ground. Think of Newton’s apple. When you drop an apple, it falls to the earth, and the force that pulls it down can be calculated using the formula force = mass × acceleration. Thus, in a Windows Phone, the accelerometer can tell you the orientation of the phone with respect to the earth’s gravitational force.

In this chapter, you will learn how to write a Windows Phone application that takes advantage of the data the accelerometer provides. In the first example, you will capture data from the accelerometer and interpret the x, y, and z values. In the second demo, you will use readings from the accelerometer to move a ball in a 2D space.

Understanding Orientation and Movement

When you hold a Windows Phone in your hand with its display facing you, think of it as occupying the origin of a three-dimensional graph with its z-axis pointing toward you (a positive direction), its y-axis pointing downward (a negative direction), and its x-axis pointing toward the right (a positive direction). Figure 6-1 shows how these three axes are positioned relative to the device when you hold it facing toward you.
An accelerometer reading of \((x, y, z) = (0, -1, 0)\) might involve standing the phone up on the table, for example, with the front of the phone facing toward you and the phone buttons facing downward, as shown in Figure 6-2.

- If you were to rotate the phone in Figure 6-2 to the right 90 degrees so that the Windows Phone control buttons were to the right, as shown in Figure 6-3, the expected accelerometer readings would be \((x, y, z) = (-1, 0, 0)\).

- If you took the phone in Figure 6-2 and rotated it 180 degrees, \((x, y, z)\) would be \((0, 1, 0)\), as shown in Figure 6-4.

- If you were to rotate the phone in Figure 6-4 to the left 90 degrees, as shown in Figure 6-5, \((x, y, z)\) would be \((1, 0, 0)\).

- If you were to put the phone flat on the table with the phone facing up, as shown in Figure 6-6, \((x, y, z)\) would be \((0, 0, -1)\).