Chapter XXXVIII
Unlocking the Hidden Power of the Mobile

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ABSTRACT

Today in the beginning of the 21st century, mobile devices are now ubiquitous. No matter where we go or what we do, we are touched by this new insatiable need for mobile computing. Mobile devices, especially mobile phones, have become the essential commodity item. In many countries the world over, mobile phone ownership is well above 100% market penetration. The main features predominantly used are text messaging and voice communications. The phones of today, however, have far more to offer than these interpersonal communication features. Many phones include components such as digital cameras, wireless data communication systems (Bluetooth), and music playback facilities. Some even include additional sensor technology such as accelerometers to detect motion. Java Virtual Machines (JVMs) are now shipped as standard with almost every phone that comes off the production line. This opens the door to a huge body of developers to create applications specifically directed to these small mobile computing devices. The area of mobile Java games is one area of growth, especially due to the ease of deployment. Mobiles are, however, capable of so much more. This chapter focuses on the computational abilities of these small portable computers. It provides a selection of concrete results that indicate that mobiles are more than capable of performing complex computational tasks; therefore, the future of computing is mobile.

INTRODUCTION

A myriad of benchmarking tools are presently available that are able to give a relative comparison of the computational and graphical capabilities of today's phones. For the majority, the computational capacity of the new phone they wish to buy may not even be considered as a required feature. Presently, text messaging and voice communication are the predominant characteristics that people look for in a phone. More and more, however, we are seeing phones that provide additional facilities, such as the playback of digital audio files. The rapid increase in the storage capacity of high-density flash memory is one of the chief technologies that is making this auditory revolution possible.

Never when purchasing a phone do you see the processor type and speed quoted on any of the literature. Even if one goes in search of this information, it is usually next to impossible to find without going to great lengths. At present this is something that neither industry nor consumers appear to value as an essential feature. In time, however, when the computational value of these devices are realized, this may change, and just as with the purchase of personal computers today, elements such as processor type and speed, system memory, graphics capabilities, and storage may become the key influential driving factors in the purchasing decisions of tomorrow's consumers.

This chapter sets out to discover the computation capabilities of some of today's phones that are Java enabled as standard. The moment that one thinks of languages such as Java or C++, they automatically think of Object-Orientated (OO) design. A selection of MIDlet applications are presented in this chapter that use the object-orientated paradigm and the more traditional structured programming approaches of program development. These applications will show that they have significant computational capabilities. To demonstrate this, the subject area of fractal generation will be used as the key test bed to provide the concrete computational capacities of phones such as the Nokia 6630 and the Nokia 6680. These applications include programs to generate the traditional Mandelbrot and Julia Sets as well as the more recently discovered Buddhabrot technique.

FRACTAL GENERATION

The Mandelbrot and Julia Sets are inexorably linked. For any point of the Mandelbrot image plane, one can generate a Julia Set that corresponds to that location. Therefore, there are infinite possibilities. The Buddhabrot technique uses the exact same generation function as the Mandelbrot Set, but the manner in which the final image is calculated and rendered is quite different, resulting in an image that is visually rich. This section will discuss some of the background of these fractal images and present the algorithms necessary for the generation of the same.

Mandelbrot and Julia Sets

The Mandelbrot and Julia Sets are perhaps the most popular class of nonlinear self-similar fractals. The actual equation and algorithm for generating both the Julia and Mandelbrot-like sets are quite similar and generally quite simple. They use the polynomial function $f : C \to C,\ f(z) = z^u + c^v$ to generate a sequence of points $\{x_n : n \geq 0\}$ in the complex plane by $x_{n+1} = f(x_n)\ \forall n \geq 0$. There have been several mathematical studies to prove that the sequence $\{x_n : n \geq 0\}$ has only two attractors: 0 and infinity. The Julia and Mandelbrot sets retain only those initial points that generate sequences attracted by 0 as Equations (1-2) show:

$$J_c = \{ x_0 \in C : x_{n+1} = f(x_n), n \geq 0 \text{ are attracted by } 0 \} \tag{1}$$

$$M = \{ c \in C : x_0 = 0, x_{n+1} = f(x_n), n \geq 0 \text{ are attracted by } 0 \} \tag{2}$$

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