Chapter 22
Micro Information Systems:
New Fractals in an Evolving IS Landscape

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ABSTRACT

We are increasingly surrounded by and using small systems, which are equipped with sensors. Mobile phones, temperature sensors, GPS tracking, emerging nano/micro-size sensors, and similar technologies are used by individuals, groups, and organizations. There are valuable applications for industries such as medical and manufacturing. These new sensor applications have implications for information systems (IS) and, the authors visualize this new class of information systems as fractals growing from an established class of systems; namely that of information systems (IS). The identified applications and implications are used as an empirical basis for creating a model for these small new information systems. Such sensor systems are called embedded systems in the technical sciences, and the authors want to couple it with general IS. They call the merger of these two important research areas (IS and embedded systems) for micro information systems (micro-IS). It is intended as a new research field within IS research. An initial framework model is established, which seeks to capture both the possibilities and constraints of this new paradigm, while looking simultaneously at the fundamental IS and ICT aspects. The chapter demonstrates the proposed micro-IS framework with a working (open source) application of open demand response systems that address the engineering aspects of this work.

INTRODUCTION

The title of the chapter includes the word fractals; that is because we see the use of sensors systems as new fractals growing off a main IS "body" as illustrated in Figure 1. By observation and with extensive experience from working with sensor systems, it has become apparent to us, that there exist kinds of system that will provide significant value to IS. These sensor systems will change how business as a whole is conducted into a better informed organization, while it may also have significant impact at the group and the individual levels. If IS recognizes the value of sensor data

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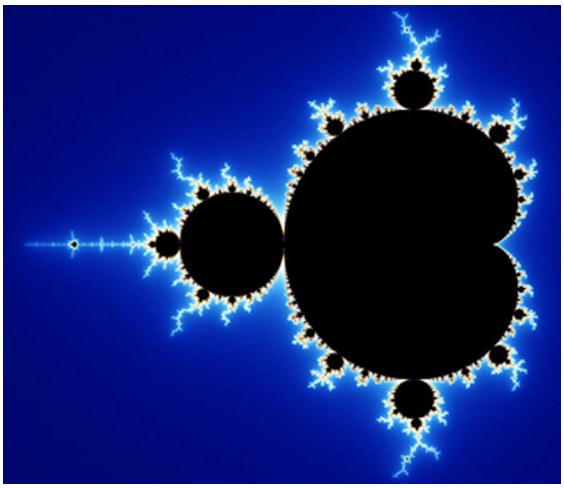
Figure 1. Mandelbrot fractals (Wikipedia: Mandelbrot: Set)



present in many natural science/social science/computer science etc. scenarios, then we believe that new levels of insight might emerge over time.

We suggest micro-IS as a prolific new research area for IS research. First, we consider embedded systems are different in many aspects from PC and server-based systems. An embedded system is customized toward a specific task, and furthermore it is subject to a different set of demands and interfaces than its PC and server-based counterparts. Embedded systems are almost always equipped with various sensors that process a sensation for a target IS. It also enables new and rejuvenated IS processes; seamless collaboration over great distances in virtual meeting rooms is one example that would use micro-IS to create a shared (virtual) context.

A second path to introduce micro-IS can be to consider the introductory words of Richard T. Watson in his brief historic overview of information technology (Watson, 2001). Our Table 1 extends Watson's Table 1 (in which he links fundamental communication technologies to the human senses) by adding an *embedded systems* row to it.

It is another way to show that embedded systems add the hearing, sight, touch, smell, and taste senses to IS systems. We note that smell and taste are more complicated inputs than sound and light, and would involve more techniques such as sensor fusion.

The set of micro-IS applications later in the chapter each interfacses one or more of these senses. The integration of embedded systems with physical processes is put forward by Edward E. Lee (E. E. Lee, 2006). What he describes from a technical point of view is also fundamental to our micro-IS proposal. Yet, we need add one more aspect to Watson's senses which is "speech" that has received much attention throughout the 20th Century due to explosive developments in radio- and cables transmission expanding human speech by a kind of "virtual proximity." Though speech is not considered a "sense" it is by far the most important synthesis of senses by which human beings are able to represent and communicate with each other. Tools that overcome the natural distance limitations to talk between human beings have been the most important extension of human capabilities the last 100 years as seen in telecommunication networks, and in mobile and wireless communication. To a very large extent we see sense-sensitive embedded systems in mobile and wireless devices that merge telecommunications and IS.

Now that we have indicated the versatility of embedded systems in Table 1 it is possible to present our argumentation for their practical

Table 1. Extending Watson's (Watson, 2001) communication technology table with embedded systems

Communication Technology	Human Senses				
	Hear	See	Touch	Smell	Taste
Embedded systems with sensors	Microphone:✓	Light and color sensors:✓	Touch sensors:✓	Open research	Open research