

## Role of Ubiquitous Computing in Recent Computing Environment

Dr. Pravin Ghosekar

pravinghosekar@yahoo.com, Dhanwate National College  
Congress Nagar, Nagpur (MS)

---

**Abstract:** Ubiquitous computing (ubiquitous computing) is the growing trend towards embedding microprocessors in everyday objects so they can communicate information. Ubiquitous computing (ubiquitous computing) is a human-computer interaction in which information processing has been thoroughly integrated into everyday objects and activities. In general, someone using ubiquitous computing may engage many computational devices and systems simultaneously, and may not necessarily be aware that they are doing so. This model is usually considered an advancement from the desktop paradigm.

The idea behind ubiquitous computing is to surround ourselves with computers and software that are carefully tuned to offer us unobtrusive assistance as we navigate through our work and personal lives.

The paper depicts how the computing environment has changed with the advancement in computing. Using this we can build an aware home, which will drive with you using some handheld devices.

**Keywords :** Ubiquitous computing, distant vision, GPS, MEMS, Clay.

---

### I. Introduction :

It is a term describing the concept of integrating computation into the environment, rather than having computers which are distinct objects. Promoters of this idea hope that embedding computation into the environment would enable people to move around and interact with computers more naturally than they currently do. It is a human-computer interaction in which information processing has been thoroughly integrated into everyday objects and activities. In general, someone using ubiquitous computing may engage many computational devices and systems simultaneously, and may not necessarily be aware that they are doing so.

Ubiquitous computing refers to a new generation of computing in which the computer completely permeates the life of the user. In ubiquitous computing, computers become a helpful but invisible force, assisting the user in meeting his or her needs without getting in the way.

The idea behind ubiquitous computing is to surround ourselves with computers and software that are carefully tuned to offer us unobtrusive assistance as we navigate through our work and personal lives. Contrast this with the world of computers as we know them now. Some are very obtrusive—remember the car that called out, “Door is opened... Door is opened...” until someone finally kicked the door shut? Others attempt to offer assistance but deliver only frustration, like that new Web camera’s automatic installation routine that didn’t quite perform all of the configuration necessary—and didn’t offer any guidance on what else needed to be done.

We are caught in an interesting trap. On one hand, we are beguiled by the promise of greater productivity and convenience. On the other, we are frustrated by tools that are brittle and unintuitive. Though much software is easier to use than ever, it feels as though we are far from the science fiction dream of unobtrusive computers that let us work naturally and that operate as seamless extensions of our personal work styles. There is hope, however. The ubiquitous computing movement is focused on this seemingly distant vision and may help us achieve the greater productivity that sits with it on the horizon.

Ubiquitous computing presents challenges across computer science: in systems design and engineering, in systems modeling, and in user interface design. Contemporary human-computer interaction models, whether command-line, menu-driven, or GUI-based, are inappropriate and inadequate to the ubiquitous case. This suggests that the “natural” interaction paradigm appropriate to a fully robust ubiquitous computing has yet to emerge - although there is also recognition in the field that in many ways we are already living in an ubiquitous world. Contemporary devices that lend some support to this latter idea include mobile phones, digital audio players, radio-frequency identification tags, GPS, and interactive whiteboards.

There are three basic forms for ubiquitous system devices: tabs, pads and boards .

- Tabs: wearable centimetre sized devices
- Pads: hand-held decimetre-sized devices
- Boards: meter sized interactive display devices.

These three forms proposed by Weiser are characterised by being macro-sized, having a planar form and on incorporating visual output displays. If we relax each of these three characteristics we can expand this range into a much more diverse and potentially more useful range of Ubiquitous Computing devices. Hence, three additional forms for ubiquitous systems have been proposed:

- Dust: miniaturised devices can be without visual output displays, e.g., Micro Electro-Mechanical Systems (MEMS), ranging from nanometres through micrometers to millimetres.
- Skin: fabrics based upon light emitting and conductive polymers, organic computer devices, can be formed into more flexible non-planar display surfaces and products such as clothes and curtains. MEMS device can also be painted onto various surfaces so that a variety of physical world structures can act as networked surfaces of MEMS.
- Clay: ensembles of MEMS can be formed into arbitrary three dimensional shapes as artefacts resembling many different kinds of physical object.

## **II. Convergence**

UbiComp is computing era that converges several computing domains and technologies to provide the goals of pushing the computing to the background, functioning calmly to perform the mundane task more intelligently. It involves expertise from the following technologies:

1. Embedded Computing
2. Mobile Computing
3. Wireless Technologies
4. Human Computer Interface
5. Sensor Networks
6. Web Technologies
7. Secure Computing
8. Grid Computing

Mobile phones have rapidly become an essential and integral part of our daily lives. We feel as if a part of us is missing if we forgetfully leave our mobile phones at home – so much so that many times we go back to retrieve this pint sized gadget in order to make ourselves ‘complete’ again! No other technology has, so quickly and pervasively, become an integral part of our ‘being’ in the last decade or the preceding years. Approximately 4 billion people today are touched by a cell signal, and cell phone penetration has exceeded 2 billion connections globally. It continues to grow at a mind-boggling speed. This revolution is very apparent in India itself as we add approximately 15 million new connections a month!

## **III. Ubiquitous Computing: The Basics**

Ubiquitous computing refers to a new generation of computing in which the computer completely permeates the life of the user. In ubiquitous computing, computers become a helpful but invisible force, assisting the user in meeting his or her needs without getting in the way.

### ***Nanotechnology and Wireless Technology***

If computers are to be everywhere, unobtrusive, and truly helpful, they must be as small as possible and capable of communicating between themselves. Technological movements supporting these goals are already well underway under the rubrics *nanotechnology* and *wireless computing*.

### ***Nanotechnology***

The trend toward miniaturization of computer components down to an atomic scale is known as nanotechnology. Nanotechnology involves building highly miniaturized computers from individual atoms or molecules acting as transistors, which are the heart of the computer chip. The number of transistors in a chip is indicative of its power. Therefore, nanotechnology’s extreme miniaturization of transistors allows for impressive levels of computing power to be put into tiny packages, which can then be unobtrusively tucked away.

### ***Wireless Computing***

Wireless computing refers to the use of wireless technology to connect computers to a network. Wireless computing is so attractive because it allows workers to escape the tether of a network cable and access network and communication services from anywhere within reach of a wireless network.

Wireless computing has attracted enormous market interest, as witnessed by consumer demand for wireless home networks, which can be purchased for several hundred dollars. The second author has a three-computer wireless network in his home.

### ***Context-Awareness and Natural Interaction***

Small computers that communicate wirelessly provide a necessary infrastructure for ubiquitous computing. However, infrastructure is only half of the battle. As noted above, the ubiquitous computing movement aims to make computers more helpful and easier to use. Indeed, computers should be able to accurately anticipate the user's needs and accommodate his or her natural communication modes and styles. These themes are captured within the ubiquitous computing movement's focus on context-aware computing and natural interaction.

### ***Context-Awareness***

The promise of context-awareness is that computers will be able to understand enough of a user's current situation to offer services, resources, or information relevant to the particular context. The attributes of context to a particular situation vary widely, and may include the user's location, current role (mother, daughter, office manager, soccer coach, etc.), past activity, and affective state. Beyond the user, context may include the current date and time, and other objects and people in the environment.

### ***Natural Interaction***

Currently, using the computer is part of the task we are attempting to accomplish—something else to focus on, learn, or do in order to accomplish a goal. The idea behind natural interaction is for the computer to supply services, resources, or information to a user without the user having to think about the rules of how to use the computer to get them. In this way, the user is not preoccupied with the dual tasks of using the computer *and* getting the services, resources, or information. Donald Norman, a well-known researcher in human-computer interaction, once said that he doesn't want a word processor; he wants a letter writer—something that will allow him to get the job done of writing a letter, without the instrument getting in the way.

## **IV. The Ubiquitous Computing in Workplace**

The elements of ubiquitous computing—nanotechnology, wireless computing, context-awareness, and natural interaction—offer a powerful set of tools to achieve the promise of ubiquitous computing. To provide a better sense of what this future holds, let's take a look at how ubiquitous computing might play out in the workplace.

### ***UbiquiTrain***

The UbiquiTrain system is based on a database of training content to which users connect via desktop computers and wireless handheld systems.

UbiquiTrain loads training content according to an algorithm that includes a number of context-related cues. The first cue centers on the user's schedule. For example, if there is an upcoming meeting called by the user, UbiquiTrain would load training content on how to lead meetings. As the meeting time approaches, this training content floats to the top of the list of topics available. A second cue invokes the context of the user's current activities.

If the user is working on a task related to an item on his or her to-do list, UbiquiTrain would load corresponding content, as well. For example, the user working on a proposal would cue UbiquiTrain to call up training content on written communication in general and proposal writing in particular.

UbiquiTrain holds content at the ready should users ask for it. The system does not demand the user's attention.

As befits the nature of ubiquitous computing, users interact with UbiquiTrain in the way that feels most natural to them. Some users talk to the system, asking it to show them a particular piece of training content. Others, not yet comfortable with talking to a computer, use the touch screen.

UbiquiTrain reacts to the user, as well. Noting the confusion on the user's face as it explains how to deal with attendees who derail meetings, for example, UbiquiTrain tries explaining the concept a different way. It then offers a short video example. Observing that the user is nodding, UbiquiTrain resumes the normal course of training. Of course, if users are looking for information on a particular topic, they can skip straight to the content simply by asking for it. UbiquiTrain is flexible enough to understand the different ways users might request a given piece of content.

UbiquiTrain is more than a means to deliver already-developed training content. The system also offers important benefits in training needs assessment by monitoring trends in training content demands across users. The system takes action when it senses a trend in demand for certain broad areas of training content among

members of particular departments or among workers with similar duties across different departments. As a means of respecting users' privacy, the system polls them and asks if they would like

to request in-depth training on the topic, taking suggestions for areas in which users might want particular detail. If sufficient interest is found, the results are then forwarded to the group responsible for training in the organization.

By observing trends in content demand, UbiquiTrain can also sense when its database is incomplete. If users ask for content that doesn't exist in the database, the request is logged. If a sufficient number of similar requests are received, the system generates a requisition for new content. In this way, the database stays current with the needs of its users.

Finally, UbiquiTrain can help evaluate the training it has delivered. The most overt way is to ask the user for feedback on the training received. A second way is to have the user request relevant coworkers to evaluate him or her in a given area at a given time, if appropriate. The rating task, of course, is administered by UbiquiTrain through the coworkers' computers or handhelds.

Raters can choose to make their ratings and comments anonymous, if they wish. Once all of the data are compiled, UbiquiTrain feeds them back to the user and offers appropriate development suggestions. The system makes use of the data, as well, to track the effectiveness of the training it has delivered.

Clearly, UbiquiTrain offers important benefits to all constituents. Users have a convenient, up-to-date training tool that unobtrusively responds to their needs. At the corporate level, the training needs within the organization are easily tracked and clearly delineated and can be analyzed to fine detail. Ubiquitous computing serves I-O psychology very nicely, indeed.

### **Concerns**

The power ubiquitous computing promises carries with it significant risks. One such risk is associated with the amount of privacy that must be sacrificed to see the benefits of truly helpful computers. Another is that early, "bleeding edge" applications of ubiquitous computing will turn out to be more ambitious than effective, leading some to prematurely conclude that the idea is a failure. We address each of these concerns below.

### **Privacy Issues**

Simply put, the more software tracks users, the more opportunities exist to trample on their right to privacy. To some degree, these issues are already being argued in the contexts of corporate e-mail snooping and the use of IT software that can track user activity down to the level of individual keystrokes. However, factoring in the idea of software that can track and act upon a user's physical presence and form of activity leads to privacy concerns of a magnitude beyond those currently debated. The privacy implications of ubiquitous computing implementations must always be accorded the most careful consideration. Without powerful standards surrounding user privacy, the future world of ubiquitous computing may very well shift from one of ease and convenience to one where each of us has an inescapable sense of being watched, at best, and no control over our personal information, at worst. Such prospects are clearly far from desirable.

### **Growing Pains**

Systems that can act as subtly as those described will not come without a substantial developer learning curve. As system developers learn from their mistakes, there will undoubtedly be at least one premature declaration that truly ubiquitous computing is an impractical ideal and that the interim efforts are too riddled with problems to be usable. We cannot guarantee that ubiquitous computing will fulfill its promise. However, we would argue that it *ought* to do so, based on the strong trend we have observed toward more powerful, more usable software. The first author recalls a word processor from about 1984 that required the manual entry of printer codes for boldface and italic fonts. Advanced ideas like templates and styles—and, come to think of it, tables—were far from consideration as features. Modern word processors are very powerful, flexible, and easy to use compared to anything that has come before. Usability is definitely a recognized goal in software design, and much has been learned to make new software—even unique, new applications—very easy to use. It should only get better.

## **V. Conclusion**

The ubiquitous computing is transforming life in which our endeavors are powerfully, though subtly, assisted by computers. The idealistic visions painted by the ubiquitous computing movement stand in stark contrast to what we see when we boot up our computers each day. There is an immediate barrier because you have to know how to use a computer to use a computer. The whole point of ubiquitous computing was to create compelling applications that would drive the development of devices and infrastructure. The real goal for ubi-comp is to provide many single-activity interactions that together promote a unified and continuous

interaction between humans and computational services. The focus for the human at any one time is not a single interface to accomplish some task. Rather, the interaction is more free-flowing and integrative, akin to our interaction with the rich physical world of people, places, and objects in our everyday lives.

### References

- [1]. Abowd, G.D., & Mynatt, E.D. Charting past, present, and future research in ubiquitous computing. *ACM Transactions on Computer-Human Interaction*
- [2]. ABOWD, G. D., BROTHERTON, J., AND BHALODIA, J. 1998b. *Automated capture, integration, and visualization of multiple media streams*. In *Proceedings of the 1998 IEEE Conference on Multimedia and Computing Systems (San Antonio, TX)*, IEEE Computer Society Press, Los Alamitos, CA, 54–63
- [3]. Bergman, E. *Information appliances and beyond*. San Francisco: Morgan Kaufman.
- [4]. Daniel Minali, Emma Minali, *Web Commerce Technology Handbooks*.
- [5]. R.K. Jena, *Trends in Information Technology & Business Intelligence*
- [6]. Raj Kamal, *Mobile Computing, BPB*
- [7]. Stanton, N.A. Ubiquitous computing: Anytime, anyplace, anywhere? [Special Issue]. *International Journal of Human-Computer Interaction*.
- [8]. Weiser M, The computer for the 21st century. *Scientific American*
- [9]. WELLNER, P. 1993. Interacting with paper on the DigitalDesk. *Commun. ACM* 36, 7 (July), 2015.
- [10]. Weiser, M. The Computer for the 21st Century. *Scientific American* , September, 1991.