

# Pervasive Computing: An Overview

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**Abstract:** Pervasive Computing is a technology which is spread everywhere from your cloths to appliances in cars and in homes to our human body to your coffee mug, can be imbedded with chips to connect the device to an infinite network of others. Pervasive Computing is also known as Ubiquitous Computing. Areas of research include software engineering, usability, open-source environments, personal navigation, wireless sensor networks, multiprocessor systems, Internet architectures and protocols and information security.

**Keywords:** Pervasive Computing, Ubiquitous Computing, Microprocessor.

## I. INTRODUCTION

Pervasive computing means the technology that is gracefully integrated in our everyday life. The user is no longer aware of this embedded technology. It is integration of Information and Communication Technology (ICT) into people lives and environment made possible by growing ability of microprocessors with inbuilt communication facility. Pervasive computing uses web technology, portable devices, mobile devices, wireless communications and nomadic or ubiquitous computing system. Other terms for pervasive computing are Ubiquitous Computing, Calm Technology and Things That Think. If we say that pervasive computing means

Anytime/Anywhere-->Any Device --> Any Network --> Any Data.

Then let's look closer at these elements:

- Anytime/anywhere: 7 days x 24 hours, global, ubiquitous access.
- Any device: PC, Palm/PDA, cell phone, and so forth.
- Any network: access, notification, data synchronization, queued transactions, wireless optimization, security, content adaptation/reformat, development tools, device and user management.
- Any data: e-mail, Personal Information Manager (PIM); inter-Intranet; public services.

There are three types of pervasive computing.

- Tabs: wearable centimeter sized devices
- Pads: hand-held decimeter-sized devices
- Boards: meter sized interactive display devices.

These 3 forms were based on the sized. The three more additional form of it –

**Dust:** miniaturized devices can be without visual output displays, e.g. Micro Electro-Mechanical Systems (MEMS),

**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.

Contemporary devices that lend some support to this latter idea include mobile phones, digital audio players, radio-frequency identification tags, GPS, and interactive white boards. Pervasive computing can be termed with Augmented Reality, Ambient Intelligence.

Pervasive computing is Internet of Things.

The principle of pervasive computing can be more clearly by following image -

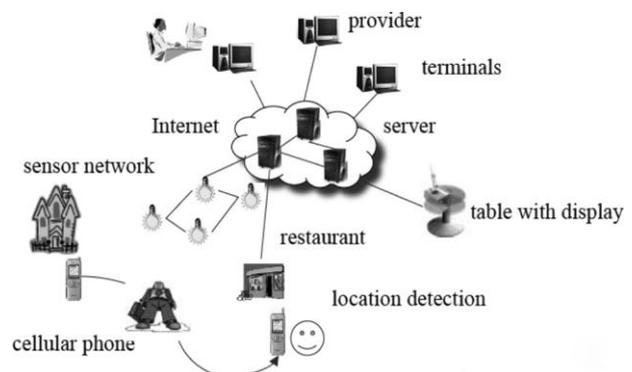


Fig 1: Principles of Pervasive Computing

## II. RELATED WORK

Ubiquitous computing was first coined by Mark Weiser, chief technologist, and John Seeley Brown, director of the Xerox Palo Alto Research Lab around 1988. There aims to create a fully "ubicom world".

Andy Hooper from Cambridge University UK proposed and demonstrated the concept of "Teleporting" - where

applications follow the user wherever he/she moves. After the huge emergence in field of wireless networks and hardware compaction many universities are conducting project and research on it: Project Natal - a line of motion sensing input devices by Microsoft for Xbox 360 and Xbox One video game consoles and Windows PCs by Microsoft Corporation which, Project Aura at Carnegie Mellon, Endeavour at UC Berkeley, Oxygen at MIT, and Portalano at Washington. Industry examples include work at AT&T, STYLE ME – a virtual fashion mirror by cisco also compromise of this technology.

Pervasive Computing integrates computing and communication capabilities with human users. For example, MIT’s Project Oxygen seeks to create a system in which computation is as pervasive as air: In the future, computation will be human centered. It will be freely available everywhere, like batteries and power sockets, or oxygen in the air we breathe...We will not need to carry our own devices around with us. Instead, Configurable generic devices, either handheld or embedded in the environment, will bring computation to us, whenever we need it and wherever we might be. As we interact with these “anonymous” devices, they will adopt our Information personalities. They will respect our desires for privacy and security. We won’t have to type, click, or learn new computer jargon. Instead, we’ll communicate naturally, using speech and gestures that describe our intend.

**Pervasive Computing Support for Hospitals:**

The activity-based computing project researched pervasive computing support for clinical hospital work. Such technologies have potential for supporting the mobile, collaborative, and disruptive use of heterogeneous embedded devices in a hospital. A professional hospital staff’s work is challenging to pervasive computing researchers in several ways. Clinicians must handle large volumes of shared data such as patient records and x-rays. Their work is team oriented, with much collaboration between different fields of expertise. It’s nomadic because treatment involves talking to patients, attending conferences, and conferring with colleagues and physicians and nurses don’t usually have desks.

**III. ISSUES**

Pervasive solutions enable anytime, anywhere information exchange and access to applications. They have microprocessor chip embedded for connection. Privacy is easily the most often-cited criticism of ubiquitous computing (ubicomp) and may be the greatest barrier to its long-term success. Public policy problems are often “preceded by long shadows, long trains of activity”, emerging slowly, over decades or even the course of a century. These are the kinds of privacy principles that have been established by the industry - but over the past two years, we have been trying to understand whether such principles reflect the concerns of the ordinary citizen.

There are many issues in the field like Pervasive Computing some are-

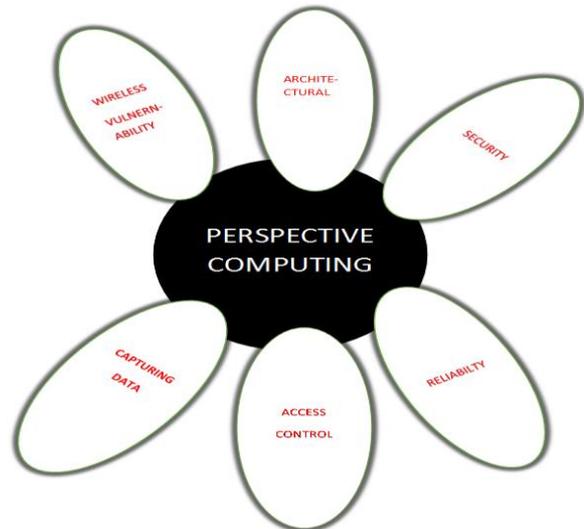


Fig 2: Issue in Pervasive Computing

Wireless Vulnerability: Wireless Vulnerability is consider with the loop holes in the area of wireless connectivity .Wi-Fi MAC Protocol Attacks are one of the most common of the wireless attack it can be-

- Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA)  
DoS attack: Clear Channel Assessment-Jamming.
- Virtual carrier sense  
DoS attack: Repeat forged RTS/CTS messages with large, NAV leading network slowdown.
- 802.11 state machine  
DoS attack: forge DE authentication or disassociation frames

In general, whenever a device or a user is authorized to perform a certain task, this event should be liable to supervision and security auditing. Also, whenever standard procedures or regulations are violated, these incidents should be recorded, too.

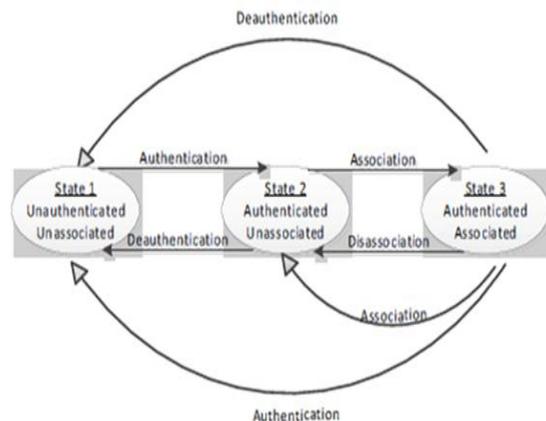


Fig 3: Wireless Issues

A. Architectural: There are many architectural issues on the base of technologies: Various applications such as Smart Room, Intelligent Navigation... can be built and used. An important aspect of the difference between pervasive computing and desktop computing. Affective Computing is the computing that relates to, arises from, or deliberately influences emotions.

According to Rosalind W. Picard -

- computer science, sensor technology, psychology, physiology
- Key technologies: face recognitions, emotional signal measurements and analysis.

Mobile Computing:

- Automatic configuration, dynamic addressing and tracking system
- Free switch between heterogeneous networks.

B. Security : Various types of Attack to a Pervasive Computing can:

- Compromise users' data,
- Crash an entire system
- Render services unavailable
- Potentially lead to the loss of property
- Harm users and even lives

Common vulnerabilities existing in wireless technologies can be like Physical jamming, passive eavesdropping and traffic analysis, Message injection and active eavesdropping, Message deletion and interception, Insider attacks to breach data confidentiality, Denial of service (DoS) attacks. Many challenges and attacks have been proved. Each operation and policy should be carefully examined against any possible attacks

C. Capturing Data: Capturing transmitted data over a public wireless network may be technically simple. Legislation in many countries requires that law enforcement agencies are able to intercept messages in the clear. But the weakening of security mechanisms to allow this also enables attackers to acquire the same messages. An attack can be their on data at the time of capturing. Whatever the computing power of a sensor might be, it will be most likely spent on sensing tasks instead of (most of the time unnecessary) cryptographic functions. Manipulating of data can be also occurred if there is any attack occurred. A sensor receiving a control message, e.g. to change its configuration, must make sure that the message is originating from an authorized process and is being delivered when it should be.

D. Access Control: Access Control should be dependable. Unauthorised or unwanted access should be avoided. The authenticity of sensor data cannot be certified directly by the sensor itself, due to computational restrictions. Access control mechanisms in the hospital require means to authenticate and authorize users and devices. Also, whenever standard procedures or regulations are violated,

these incidents should be recorded, too. If somehow unauthorised access is occurred then the unwanted user should not have right to manipulate the data.

E. Reliability: There is a big challenge of creating a reliable system such as other ubiquitous device at home – telephone or washing machine that are virtually cash free. Different standards of reliability between desktop Applications and domestic technologies. Reliability has effect on development culture, technological approaches, and expectation in markets, regulations.

#### IV. APPLICATIONS

There are following application or uses of pervasive computing-

A. Style Me: Style Me or Virtual fashion mirror uses the latest augmented reality, mobile, and network technologies to offer shoppers a virtual fashion mirror for "trying on" products virtually. Virtual Fashion Mirror is considered as a latest marketing tool. It is developed to create new boom in field of offline shopping & to make it more entertaining. It scans the motion of the body & produce augmented mirror image of body on the mirror .This will give the user the impression that he or she wears garments on screen.

B. Smart Pen: It is a pen which offers a way for finding out definition of vocabulary. Reader can also save important phrases. We can also translate the document from one language to other by just underline or write unknown word and press translate key.

C. Gate Reminder: We generally forget some important keys when we leave from house like keys, wallet etc. But now this Gate reminder will remind you about the things you only need to save the items in it and it will remind you all about them when you were leaving the house.

D. Electronic Paper: E-paper is developed for saving the tree. E-paper consist of monitor screen which can be rolled up or folded and also have latest updates of news. There is also software created by cisco which make virtual environment of the news on our phone or tablet.

E. Smart Watch: A smart watch (or smart watch) is a computerized wristwatch with functionality that is enhanced beyond timekeeping. While early models can perform basic tasks, such as calculations, translations, and game-playing, modern smart watches are effectively wearable computers. Many smart watches run mobile apps, while a smaller number of models run a mobile operating system and function as portable media players, offering playback of FM radio, audio, and video files to the user via a Bluetooth headset

F. GPS Watch: A GPS watch is a device with integrated GPS receiver that is worn as a single unit strapped onto a wrist, in the manner of a watch. The watch can have other

features and capabilities depending on its intended purpose. GPS watches are most often used for sports and fitness purposes

Some other applications of Pervasive Computing are Smart Bed, Smart Wardrobe, Smart Greenhouse, Smart Mat, Heart rate monitor etc.

Thus Pervasive Computing is use in every field like medical, entertainment, crockery and utensils, fitness, research, automobiles etc.

## V. CONCLUSION

By this paper we can see that what are concept of pervasive computing, problems or issues related to pervasive computing and how these problems can be solved. Confidentiality, Integrity, and Availability (CIA) are essential to pervasive computing applications since sensitive and real-time information may flow over any type of wireless links. Many challenges and attacks have been proved. Each operation and policy should be carefully examined against any possible attacks. By this we must be also aware about the latest applications of pervasive computing and in which fields like medical, information transfer etc. pervasive computing can be applied.

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