

Ubiquitous Computing Architecture, Applications and Challenges

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Abstract— Pervasive computing is emerging field of Information Technology. Use of pervasive computing in human life is increasing. To improve quality of human life we can use pervasive computing. This paper discusses basic idea of pervasive computing, the application of pervasive computing in human life and challenges in front of its implementation.

Keywords- Pervasive computing, Healthcare, Information Technology, Pervasive computing applications

I. INTRODUCTION

Pervasive computing is relatively new field of Information Technology. The term Pervasive computing is first used by Mark Weiser in 1988 in his paper the computer for the 21st century. [1] He is known as father of Pervasive Computing. After Mainframe and Personal computer era, current era is of Pervasive Computing. Simple concept of pervasive computing is to create such software's which will work to improve human life using different devices on which these software's will work and interconnected by specific network which is secure network.

Pervasive computing allows us to use modern technologies together to create interconnected device system. It is also known as ubiquitous computing. Pervasive computing goes beyond the concept of personal computing because it can connect basic home, kitchen, electronic appliances, could be embedded with microchips, could be controlled from anywhere. Pervasive computing is modern field in which many computational devices used to process information.

In near future Pervasive computing will play crucial role in Day-to-day human activities. This technology will allow, use of combination of different technologies such as Wi-Fi, Wireless Technology, Machine learning, artificial intelligence, Voice reorganization, image processing and soft computing.

What Mark stated was very important he was expecting such system which will automatically help its users without disturbing them. "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it" was Mark Weiser's statement in his paper in Scientific American in 1991. [2]

In Last 10 year's computer science and Information technology field developed rapidly. Many new technologies were introduced during this period. Many organizations are working in pervasive computing filed. They are doing research. Some organizations implemented pervasive computing in different field.

According to D. Norman, computing devices well become more specialized in purpose, and will be designed to serve a well defined set of tasks only [3] Pervasive computing can be used in different fields like Transportation, Education, Satellite Technology, House Management, Office Management and

many more. This Paper will discuss what is pervasive computing, Architecture of Pervasive computing and its use in Healthcare sector and challenges in front of it.

II. ARCHITECTURE

Mark Weiser proposed three basic forms for pervasive computing system devices. All computing devices are categorized in three basic forms Tabs, Pads and Boards. A tabs device includes wearable centimeter sized devices. A pad devices includes hand-held decimeter sized devices and Boards devices includes meter sized interactive display devices. [1]

Basic architecture of any pervasive computing system consists of 3 areas,

- Computing or smart Pervasive Devices
- Connectivity (Network)
- Software's

Using these 3 basic areas pervasive computing system will provide application. Computing or smart devices are nothing but input or output devices such as phones, sensors, monitors, mobile phones, cameras, human face reorganization devices, wireless devices which will collect data and will send that data over the network which is used for connectivity. It is possible that more than one system's are connected to the network.

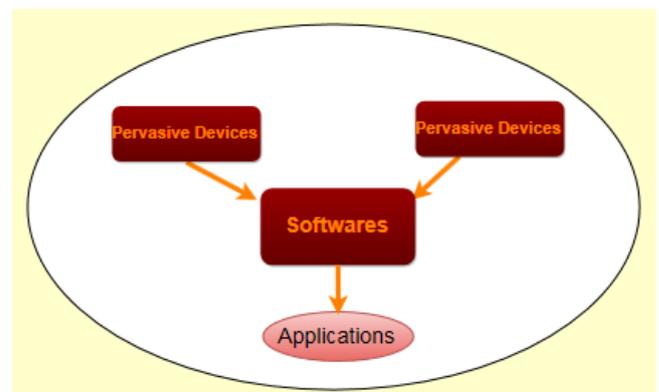


Figure 1. Architecture of Pervasive System

For connectivity of pervasive computing devices, different types of networks can be used in pervasive computing. Traditional LAN (Local Area Network), Wireless LAN,

Metropolitan Area Network and Wide Area Network are used. These networks will connect all pervasive computing devices in the system.

System needs middleware's to connect end devices with the system. The application of the pervasive system is to collect data using pervasive devices (more than one pervasive device) through network it will deliver that data to software's which will process data to get output.

III. APPLICATIONS OF PERVASIVE COMPUTING

Mark Weiser described this vision of a continual and ubiquitous exchange transcending the borders of applications, media, and countries as "everything, always, everywhere."^[2]

Combination of technologies is used to make pervasive computing Application of pervasive computing is possible in every part of human life. Some applications are listed below:

1. Traffic Control System – In India we use traditional signal system to manage traffic on busy roads. Many automobile companies provide smart features that assists driver of vehicle. Addition to this we can provide networking to connect such systems with city traffic control system. If all such systems are interconnected we can provide better solution. This is the actual aim of pervasive computing.
2. Internet Commerce – Pervasive computing system allow selling and buying products smartly over the internet. Location based monitoring ads; quality shipping service, Smart systems can assist in delivering products on time.

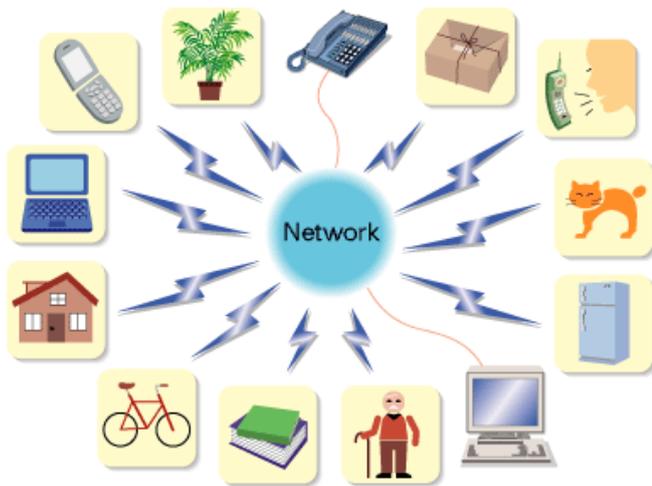


Figure 2. Home Pervasive System^[3]

3. Communication - Pervasive computing can be used in data transmission and communication. All traditional networking devices communicate through networks which will become smart with use of pervasive computing.

4. Defense Sector – Pervasive computing system can be used for the security of people and to protect public life. In India providing security to public is state's responsibility. Internal security, law and order, flood management, disaster management are state subjects. On the other hand Indian Army provides security to entire nation. Pervasive system can include sensor system, monitoring system and identification system to provide better security to people using more resources together.^[5]

5. Home Pervasive system – Smart home pervasive system consists network of home equipment's like air conditioner, electrical system and home Wi-Fi network. Many day to day tasks can be automatized using pervasive system.

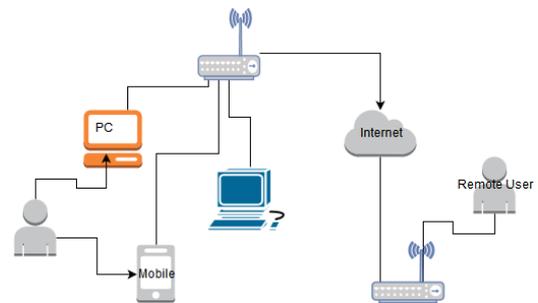


Figure 3. Home Pervasive System

6. Healthcare
 Regular propensities and exercises show a vital wellspring of data and might frequently give data of restorative noteworthiness. Healthcare Pervasive computing system emphasizes on monitoring patients vital health parameters. Capturing patient's motion is important part of pervasive system.^[9]

IV. CHALLENGES IN PERVASIVE COMPUTING APPLICATIONS

Major concern in pervasive computing applications is safety of data. Due to Adhoc manner which combines devices in network pervasive computing is not entirely secure. Security related applications or personal application where providing security is major requirement should be focused. If vital information is exchanged especially personal information in such pervasive networks then such system are expected to produce positive outcome. Protection of personal information will be big challenge in coming years.

Because of Adhoc nature of pervasive computing systems and distributed network, this system is open to several unique vulnerabilities.

One more challenge is that traditional interface which we use to communicate with machines like menu driven GUI are not suitable for pervasive systems. Modern devices like GPS based devices, sensors, mobile devices are required to implement ubiquitous computing.

Scalability, integration, invisibility, context Awareness and mobility are the few more challenges to be addressed.^[10]

V. CONCLUSION

We can have human to human interaction, machine to machine interaction and human to machine interaction. Pervasive computing will fall into human to machine interaction. IOT is one more new branch of pervasive computing where focus is on machine to machine interactions. In both interactions the vision of pervasive computing is now reality. Human is interacting with multiple machines. Pervasive computing is changing our life. The focus of this paper is to collect information of pervasive computing, its applications and challenges. In future I will focus on building pervasive computing model which can be used to design smart home.

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