

Pervasive Computing: Study for Homes

Dhanshri Parihar and A.J. Singh

Department of Computer Science,

Himachal Pradesh University,

Summer Hill, Shimla 171005, India

tanshi.engg@yahoo.in, aj_singh_69@yahoo.co.uk

Abstract: *Computing world is an incredibly growing area having pervasive computing as an emerging computing environment. The aim of pervasive computing is to create such an environment that is familiar to the user and this is done by embedding multiple electronic devices in user environment without making the technology and the computing devices visible to the user. After revolutionizing the business world pervasive computing is being making changes in the homes. This paper introduces the emergence of pervasive computing in the homes. Based on interviews conducted at home we explored the multiple user prospects about the pervasive computing environment at homes. The paper ends up with the discussions on the challenges and the future devices of pervasive computing at homes.*

Keywords: *Pervasive computing, environment, ubiquitous computing, smart devices.*

1. Introduction

Mark Weiser, the American scientist introduces the term ubiquitous computing in 1988 later termed as pervasive computing. Pervasive computing simply means computing everywhere. The pervasive computing

is enhancement to mobile computing [3] which is enhanced by integrating wireless technology into mobile infrastructure [1]. Mark Weiser had rightly said "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it"[4]. This vision totally changes the computing world as computing is now not only restricted to the research labs but becoming the part of human daily life. For the pervasive computing to pervade in users environment, devices, connectivity (wired or wireless) and user interfaces are needed [14]. The technology market which is previously be involved in making the products only for the business world and education area is now moving towards building the products for the homes as homes are the most important part of human life. People invest extraordinary amounts of time, money, and emotional energy to mold their homes into living spaces that meet their needs [5]. Multiple electronic devices are being used in these days at homes like refrigerators, microwave oven, cell Phones, TV, laptops, PDA's, washing machines, digital cameras etc. as seen in Figure.1. So the key idea behind making the pervasive computing to enter at home is to just make the electronic devices at home interconnected to handheld devices or any other sense and control appliances that enables the user to make remote access and control to the devices at home or for managing the automatic functioning of devices on user behalf. For example the car navigation systems or the GPS (global positioning systems) is a special kind of functional satellite navigation system that comprises satellites and sensors along with an inbuilt computer directing software that helps to give directions for a particular destination and enables the driver to reach the desired destinations conveniently. The goal of this paper is to understand the user views about pervasive computing environment for homes.

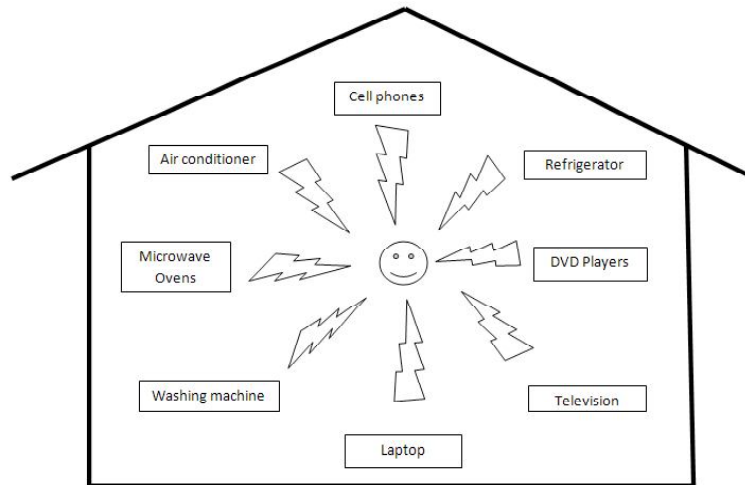


Figure.1. Pervasive computing home environment

The structure of paper is as follows, section 2 motivates our research with an example scenario on the basis of which interview is conducted at home along with 5 different users, section 3 is an example scenario, section 4 includes the interview findings, and overview of the observations on the technology, section 5 includes discussions on challenges. Finally, section 6 concludes this paper with a discussion.

2. Motivation

Pervasive computing environments generally implemented by embedding smart devices in the environment. A smart device is a device that is digital, active, computer networked, is user reconfigurable and that can operate to some extent autonomously. For the better illustration of this environment our example scenario presents one of such smart device that is a refrigerator with sensors based technology that is adjusting the cooling automatically with the variations in the room temperature on user behalf.

3. Example Scenario

“There is an electronic device, a refrigerator at home this refrigerator is embedded with temperature sensors within it. The sensor senses the room temperature and adjusts the cooling of the fridge according to the variations in the room temperature. The fridge along with temperature sensor has a door alarm which rings when door is remained open for 2 minutes”.

4. Interview Findings and Overview of Observations

In order to study the prospect of multiple users about pervasive computer environments at home we have interviewed five users of different age groups for depicting the observations about the example scenario in the Solan city of Himachal Pradesh. We just fix a time period of 2 days for each user to make use of sensor embedded fridge in order to place the different users in simple pervasive computing environment at home and to analyze their views about such embedded devices in user environment at home in future.

USERS	AGE	GENDER	OCCUPATION	INTERVIEW TIME DURATION(min)
User1	52	Male	Govt. employee	30
User2	19	Male	Engg. student	35
User3	34	Female	House wife	30
User4	25	Male	Lecturer	30
User5	14	Male	School student	40

Table1. Profiles of the Interviewers

4.1 Observations

Individual interview is conducted for user's .User2, user4, user5, the user under age 25 find the technology interesting as the common view of users of this age group is that their additional workload of making the temperature variation is removed. User3 likes the door alarm theme of refrigerator the most for example she says

Researcher: *Would you like the refrigerator with this technology?*

User3: *I like it.*

Researcher: *oh really!*

User3: *Yes, I just love the door alarm technique as I got rid of making checks again and again whether the door is closed or not because my children just used to keep the door of refrigerator open.*

The observations results are truly positive and all the user just like it except user1 a 52 year old male who just says “**People just need to be smart for using the smart devices**”. He just find the devices appropriate for the new generation people not for the old villagers of Solan city to whom technology is worth nothing and bit difficult to use.

4.2 Proposals and emerging themes for future technology

When the users are being asked about such futuristic devices, some user proposed that in future the refrigerator may have voice interactions with user indicating the information related to the groceries in the refrigerator or may have a digital screen displays indicating the information of all the items in fridge. User5 a 14 year old school student totally gives the amazing answers for example

Researcher: *What devices you would like to use in your home in future?*

User5: *I just want a smart device called a smart watch which is being capable of storing my reminders. I just set a reminder for my favorite cartoon channel in the watch and when the alarm buzzes and I enter the living room the TV set just turn on from the interfacing through my watch and just switch to my cartoon program.*

So we observe that the example scenario just open the mind and changes the user thinking about the home environments they just now switch their ideas to smart environments with proposed smart devices.

5. Challenges

There are enormous hurdles for implementing pervasive computing in the home environments, such as device integration and device mobility [10]. Integration is a particular problem, because the portable devices operate on a variety of platforms and use a variety of communications protocols. Mobility introduces problems such as the maintenance of connections as devices move between areas of differing network connectivity, and the handling of network disconnections. Another issue with pervasive computing environment is safety [6], and trust [8], [11]. The pervasive computing is generally used for providing comfort to the user. Safety is defined as “the condition of being safe from undergoing or causing hurt, injury or loss”. If the system undergoes failure then the devices embedded in the pervasive computing environment must be capable of making indications to user about its failures. Trust is generally related to user authentication, since the user that is making access to the devices must be the authenticated user. For example an electronic home security system having certain voice reorganizations or code, so it must be capable of recognizing the authenticated user else the system will be of no use. Moreover the pervasive computing also suffers from adaptation invisibility [2]. The invisibility of applications is accomplished by reducing input from users and replacing it with knowledge of context. Dey and Abowd [13], defined context as a piece of information that can be characterize the situation of the participant in an interaction. The infrastructure for pervasive computing should support context awareness [7],[9],[12], by facilitating the gathering of information from sources such as sensors and resource monitors; performing interpretation of data; carrying out dissemination of contextual information to interested parties in a scalable and timely fashion; and providing models for programming context-aware applications.

6. Conclusion

In this paper we just examined the user views about pervasive computing home environments. Pervasive computing aims to enable people to accomplish an increasing number of personal and professional transactions using a new class of intelligent and portable devices. It gives people

convenient access to relevant information stored on powerful networks, allowing them to easily take action anywhere, anytime. We just identified the human behavior in a different environment, the technology should not become wise until, and unless the user for which it has been made should not recognize it. So the key idea of placing the persons in workable practical environment is the right way to understand the adaptability of the pervasive computing environment. We have come to understand more about the issue of usability of household technologies and indeed about the concept of household itself. Along with all these things we have presented a vision of a future computing landscape characterized by the ubiquity of computing devices.

Acknowledgement

The work described in this paper was supported in part by Department of Computer Science, Himachal Pradesh University Summerhill Shimla, India.

References

1. Ruimin, Hongji Yang Liu, Yangsheng Wang, Wei Pan: An Evolutionary System Development Approach in A Pervasive Computing Environment. In: Proceedings of the 2004 International Conference on Cyberworlds (CW'04) IEEE
2. M. Satyanarayanan: Pervasive Computing: Vision and Challenges. In: IEEE Personal Communications, (2001)
3. DR. Sanjay Sharma, Pushpinder Singh Patheja, Akhilesh A. Wao: Challenges for Mobile Wireless Devices for Next Generation in Pervasive Computing. International Journal of Soft Computing and Engineering ISSN: 2231-2307, Volume-1, Issue-1, March (2011)
4. M. Weiser: The Computer for the Twenty-First Century. In: "Scientific American, pp. 94-10, September, (1991)
5. Stephen S. Intille, MIT School of Architecture, and Planning: Designing the home of future. Pervasive computing article APRIL–JUNE (2002) IEEE

6. Hen-I Yang and Abdelsalam Helal: Safety Enhancing Mechanisms for Pervasive Computing Systems in Intelligent Environments. In: Sixth Annual IEEE International Conference on Pervasive Computing and Communications (2008)
7. Kay Connelly: On Developing a Technology Acceptance Model for Pervasive Computing. In: the Proceedings of Ubiquitous System Evaluation (USE) — a workshop at the Ninth International Conference on Ubiquitous Computing (UBICOMP), September, (2007)
8. Munirul Haque and Sheikh Iqbal Ahmed : Security in Pervasive Computing: Current Status and Open Issues .International Journal of Network Security, Vol.3, No.3, PP.203–214, Nov. (2006)
9. Prof. Yenumula Venkataramana Reddy West Virginia University, Morgantown, WV 26508, USA: Pervasive Computing: Implications, Opportunities, and Challenges for the Society. In: 2006 1st International Symposium on Pervasive Computing and Applications
10. Mark Weiser: Some Computer Science Issues in Ubiquitous Computing. In: IEEE Computer “Hot Topics”, October (1993)
11. Jianhua Ma, Qiangfu Zhao, Vipin Chaudhary, Jingde Cheng, Laurence T. Yang, Runhe Huang, and Qun Jin: Ubisafe Computing: Vision and Challenges (I). L.T. Yang et al. (Eds.): ATC 2006, LNCS 4158, pp. 386 – 397, 2006. Springer-Verlag Berlin Heidelberg (2006)
12. Anand Ranganathan, Jalal Al-Muhtadi, Jacob Biehl, Brian Ziebart, Roy H. Campbell, Brian Bailey, University of Illinois at Urbana-Champaign: Towards a Pervasive Computing Benchmark. Proceedings of the 3rd Int'l Conf. on Pervasive Computing and Communications Workshops (PerCom 2005 Workshops) 2005 IEEE
13. Dey, A.K., Abowd, G.D. (1999.): Towards a better understanding of Context and Context-Awareness. GVU Technical Report GITGVU-99-22, College of Computing, Georgia Institute of Technology
14. Postnote May 2006, <http://www.parliament.uk>