

# Information Cyberspace and Future Cyber Homes

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**Abstract**—The current Internet combines very complex communications infrastructures, while connecting users globally and at the same time creating information cyberspace systems. Large companies such as Philips are working on communications technologies that will facilitate fully automated households (i.e., Cyber Homes). Today, people are using small digital pagers and phones with embedded computers and displays, palm-size computers such as Palm Pilot, notebook-size panel computers and wall-size displays. Current research and development trends in the field of Telecommunications and computing industries continues towards a human centric computing, smart spaces, smart devices, clothing, fully automated houses etc. This new technology creates environment where computers are everywhere and provide online access to information at any time to anyone. In this paper, the author discusses new technological trends directions in the Internet, E-commerce and Automation Industries, while presenting his own vision on application of ubiquitous computing in the future cyber home automation. In support of creating future fully automated cyber homes, the author promotes creation of interdisciplinary and multinational research and development teams world-wide.

**Index Terms**—Cyberspace, Cyber Homes, Ubiquitous Computing.

## I. INTRODUCTION

There is no facet of life in the industrialized world that has not undergone some form of shift. The resultant new information economy has brought with it different approaches to work. The past 20<sup>th</sup> century left us with legacy of the global Internet, final flight of Concorde Air, CISCO monopoly in computer networking, etc., while large, medium and small corporations alike have discovered the need to adapt to the new technologies, or sink in the emerging global knowledge economy. The current 21<sup>st</sup> century is perhaps one of the most interesting times in history to be alive. We are witnessing a phenomenal abundance of change in societies around the world in a very short period. The source of most of this change is new technologies and the Internet. In the past decade we have seen every aspect of the lives of individuals and organizations go through many evolutions and uncertainties [1]. The Telecommunications and Internet Technologies have evolved dramatically during the last decade, laying solid foundation for the future generation of the Ubiquitous Internet access, omnipresent web technologies and ultimate automated information cyberspace.

There are plenty of publications on the subject of futuristic and ubiquitous computing for the 21st century presenting excellent discussion and possible scenarios in the subject area [2, 3, 4, 5 & 6]. History proved that one must look forward and accept the futuristic vision as

possible scenarios of tomorrow's reality. Nowadays, technologies such as TV, Internet, Mobile Phone, Traffic lights, cameras are essential part of daily life [7, 8, 9, 10, 11 & 12]. However, if one would suggest hundred years ago what would be the reality of 2005, surely he or she would be considered "with great caution" [13, 14]. Mark Weiser idea of ubiquitous computing was that computation will be embedded in many different kinds of devices on many different levels.

The paper is structured in five sections. First section presents introduction and historical background, second section discusses basic concepts of ubiquitous computing, while the third section discusses impact of omnipresent Internet on automation and commerce. The section four presents Mark Weiser's vision and future cyber home. Conclusions and suggest further research directions are discussed in section five.

## II. UBIQUITOUS COMPUTING

Ubiquitous computing, by its very definition, aspires to weave computing technologies across the fabric of our everyday lives [27]. There is burgeoning population of 'effectively invisible' computers around us, embedded in the fabric of our homes, shops, vehicles, farms and some even in our bodies. They are invisible in that they are part of the environment and we can interact with them as we go about our normal activities. However they can range in size from large Plasma displays on the walls of buildings to microchips implanted in the human body. They help us command, control, communicate, do business, travel and entertain ourselves, and these 'invisible' computers are far more numerous than their desktop cousins. How many computers will you be using, wearing, or have installed in your body, in 2020? Thanks to current globalization, we see more and more people working and living on the move. In support of this new mobile lifestyle, especially as our work becomes more intensely information-based, companies are producing portable and embedded information computational portable devices creating a wireless island of connectivity. These wireless islands are automatically composing a computational environment to support the workers needs. Workers are connected directly to information cyberspace and work together across the range of context. Each wireless island defines a context of available services, embedded device, and task-specific information. Pervasive computing environments, such as the ones studied in CMU's Aura project [15], provide many kinds of information. Some of this information should be accessible only by a limited set of people. For example, a person's location is a sensitive piece of information, and releasing it to unauthorized entities might pose security and privacy risks. For instance, when walking home at night, a person will want to limit the risk of being robbed, and only people trusted by the person

should be able to learn about her current location. The access control requirements of information available in a pervasive computing environment have not been thoroughly studied. This information is inherently different from information such as files stored in a file system or objects stored in a database, whose access control requirements have been widely studied. The market is evolving from wired computing to pervasive computing, mobile and wireless, anytime at anyplace. Many types of information available in a pervasive computing environment, such as people location information, should be accessible only by a limited set of people. Some properties of the information raise unique challenges for the design of an access control mechanism: Information can emanate from more than one source, it might change its nature or granularity before reaching its final receiver and it can flow through nodes administrated by different entities and specific utility devices [16].

### III. AUTOMATION AND COMMERCE VIA OMNIPRESENT INTERNET

Automation is term for the combination of the automatic machines into integrated production lines, which automatically handling of the materials between operations and automatic scheduling of each machine to keep in step with the line. One of the keys to such a line is the automatic transfer machine, which moves the work pieces from one operating station to another. However, automation also requires integration of the design of all the machines in the line including provision for maintenance, control of tool wear and replacement [17]. Automation did inspire number of outstanding scientists and engineers in the past centuries to find new solution to ease lives for all mankind. The emergence and accessibility of advanced data and telecommunications technologies combined with convergence of industry standards, as well as the convergence of data and telecommunications industries contribute towards the ubiquitous access to information resources via Internet [11, 12]. The automated environment and cyberspace systems for the 21<sup>st</sup> century entered a new era of innovation and technological advancements. World's industry and commerce are becoming more and more computerized having a global vision for the future. With increased benefits and improvements in overall information technology, the benefit-to-cost ratio has never been higher. It is essential to continue in the developments of industry standards and application of information technologies in order to increase the automation and ultimate success of modern logistics, the E-Commerce and E-manufacturing industries [18, 19]. The automated environment and cyberspace systems for the 21<sup>st</sup> century entered a new era of innovation and technological advancements. World's industry and commerce are becoming more and more computerized having a global vision for the future [20]. The manufacturing and automation technologies have cross the frontiers from nanotechnology to Giga Byte Communications Networks Infrastructures that are essential in enabling the information flow between robots, powerful computing centres and man controlled stations. The current merger of current Computer Integrated Manufacturing Technologies and Data-Telecommunications Technologies present a new challenge to community of engineers and scientists in

the manufacturing sector as well as, mathematics and computing science and engineering sector [21, 22 & 23]. The economic prospects for 2005/10 remain particularly hard to predict. Whilst the markets for Control and Power industry proved to be challenge for the companies, the Software and Automation industry have grown, particularly those businesses serving the oil, gas, power generation and auto markets [20]. What gives rise to pressures in the market place are company drivers in conjunction with the industry drives. Globalization of the market with accelerating technological changes such as digital revolution and mobile technologies in conjunction with the customer demands represent main industrial drivers [18]. On the company side it is the cost efficiency combined with the new lines of products that give rise to business complexity. The major forces in industry today are e-commerce and e-manufacturing [7]. E-manufacturing has been well adopted in industry overseas and the next wave of the e-manufacturing is driven by customers utilizing full capacity of e-commerce [8]. Toyota is one of many examples where e-manufacturing has become a major force for their productivity and business success. Future technological advancements open a new avenue for multidisciplinary development and research teams consisting of IT professionals such program developers, telecommunications engineers, production engineers and business managers to work closely with academics and industrial research teams on new e-manufacturing solutions. Sales marketing forces combined with the manufacturing and operation teams work together to plan the dynamics for future vision and the current reality, while facilitating supply chain of products in respond to customer chaotic orders. A firm's ability to serve its customers needs determines its success. Initially, firms needed to meet face-to-face to meet most of their customer's needs; however, with the development of information technology, the requirement for face-to-face interaction has gradually declined. The Internet opened up a new channel for firm-customer interaction that has significantly changed the customer relationship equation. Now, cell phone networks are enabling m-commerce and further change in the firm-customer dynamics [24]. Traditionally, business has been biased by geography and located near rivers, roads, and other transport services so that the cost of being reached by customer or reaching customers is lowered. Now, business is increasingly using electronic networks (e.g., the Internet and mobile phone networks) to interact with customers. Thus in the next few years, it is likely that we will see the emergence of u-commerce, where u stands for ubiquitous, universal, unique, and unison. U-Commerce is the use of ubiquitous networks to support personalized and uninterrupted communications and transactions between a firm and its various stakeholders to provide a level of value over, above, and beyond traditional commerce. U-Commerce represents the use of ubiquitous networks to support personalized and uninterrupted communications and transactions between a firm and its various stakeholders to provide a level of value over, above, and beyond traditional commerce. Ubiquitous represents concept of having [24] a networks everywhere with all consumer durable devices, with the intelligence and information widely dispersed and always accessible, as well as smart entities including appliances, buildings, signs, street smart communities, etc. The main focus is to enable one global network that would be available 24

hours a day, seven days a week, whole year round and will provide best quality of services to anyone, anywhere and anytime. World's telecommunications providers are looking for the ways to merge together all digital and analogue services (voice, video & data) on one common network, which would provide users with unlimited access to online information, business, entertainment, etc. Convergence's goal is to provide corporations with a highly secure and controllable solution that supports real-time collaborative applications [10].

#### IV. FUTURE CYBER HOME

In last decade, number of researcher articles presented vision and illustrated the scenarios of futuristic computing systems in the year 2005 [20, 22]. Today, we are in the 2005 and much of the foreseen technology is already implemented and fully integrated in industry, military, businesses, education and home.

Mark Weiser in his article written in 1996 wrote about futuristic computer technologies applied in "Smart House in the year 2005" [14]. Mark Weiser's vision did indeed materialized and some of his concepts are currently ongoing research and implementation projects. Ultimately the ubiquitous computer and Internet technologies should make living more comfortable for all. Looking back at my own graduation in London in 1991, I remember a statement made by the Distinguish Professor of Computer Science who was awarded the Doctor of Science degree. He said: "Computer technology today has influenced almost every aspect of our lives, industry, business, education. However, most unfortunately computer technologies have mechanized the relationship between people due to e-mail and Internet technologies. It is important that the research, academic and industrial community work together to reverse that equation, whereby computer technology will be a tool that will improve human lives and mutual interaction." Author encourages reader to reflect on that statement.

Let us imagine scenario where you and I will live in the "Cyber Home 2015". Early morning, just before the sunrise the fridge will send a message to local milkman, baker and fruit-vegetable market to make sure that best quality breakfast will be as planned. While fridge completes its duties for the rest of the day and order all fresh food necessary for the day, the "Local Information House Center" will make sure that dining room is ready (i.e., silent vacuum cleaner and window washer completed it's job just before the sunrise. Garden is tendered everyday, garage is looking after car, making sure that batteries are fully recharged and that heat fits with the local weather forecast. Chairs, table, all kitchen appliances are ready and in place. Son after breakfast they will proceed with self cleaning, self storage. The "Local Information Health Centre" will examine the hygiene in the house and diagnose all possible viruses that are in the area and in the work place. All necessary vitamins and medications will be administered automatically and painlessly. For those who are overweigh if agreed to in-house regime policies, food chain calories will be carefully supervised and monitored by fully automated cook and service appliances. Every member of the family will have automatically prescribed the educational and entertainment programs according to their position (i.e., pupil, student, engineer, academic, worker, etc.) In addition, the Local Heath Centre will monitor house

members' state of health per 24 hours, every day, consult the "Medical Database" and automatically alert the house member and local doctor in case of urgency. In light of current climate changes and frequent natural disasters it may become essential to design and implement "House Automatic Positioning Systems" and "Security Systems", which will be carefully monitored and controlled remotely by the house owner or if necessary by the "Local Weather Centre". In case of natural disasters these systems will protect the house and its members while switching to contingency plan B. Well, all we need is to wait until 2015 and see if this vision will materialize. Intra Communications systems of the future cyber homes will apply sophisticated MIMO antenna systems and small smart devices that will be able to communicate within themselves all the time. These devices will have self healing capabilities to make sure that they are recharged regularly and will be operational without any interruption. Similar to us humans we have breakfast, lunch, dinner and snack on accession to make sure that we are able to do our job, and yet we sleep anywhere from 6 to 14 hours each day. Device creating the fully automated space can not sleep, perhaps they may wait or be on pause mode, but as soldiers they must be in full operational readiness at any time and anywhere. The advancement of current technologies in the fields such as data and telecommunications, ubiquitous Internet access and sensor technologies combined with the new revolutionary explorations and concepts in biotechnology and nanotechnology, computer human interface-interaction, etc., present a great challenge for the research community not only as a result of mathematical complexity, but most of all by the user's perception [25].

#### V. CONCLUSIONS

The majority of homes today are connected to Internet and most of the household electronic devices could be remotely controlled. In this paper, author presents his own vision on future cyber home with fully automated environment via information cyberspace for the year 2015 and new directions in the research areas of ubiquitous computing and applied automation. A future vision on communication systems cannot be complete without the definition of the future application scenario. A good starting point from which to draw trends for the future scenario is to look at our children who work as engineers in next 15 years [26]. The paper discusses Weisser vision on future computing. Mark Wiser vision has become a reality of today and future evolution of E-M and U Commerce and Network Convergence. Modern communications and mecatronics technology creates a platform for the future developments in ubiquitous computing and creation of future fully automated cyber homes.

Research efforts should be focused on designing a communication languages and transmissions media that will allow for instantaneous communication transfer and control between smart devices and humans (i.e., voice triggered remote control and automation). The future technological advancements open a new avenue for multidisciplinary development and research teams consisting of IT professionals such program developers, telecommunications engineers, production engineers and business managers to work closely with academics and industrial research teams on new concepts of future cyber

homes. Applied robotics, logistics, smart devices, smart antennas and intelligent systems will create platform for the integration of automated environments and intelligent cyberspaces.

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