A

Seminar report

On

Ambient Intelligence

Submitted in partial fulfillment of the requirement for the award of degree Of Civil

SUBMITTED TO: **SUBMITTED BY:**

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Acknowledgement

I would like to thank respected Mr…….. and Mr. ……..for giving me such a wonderful opportunity to expand my knowledge for my own branch and giving me guidelines to present a seminar report. It helped me a lot to realize of what we study for.

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Preface

I have made this report file on the topic **Ambient intelligence;** I have tried my best to elucidate all the relevant detail to the topic to be included in the report. While in the beginning I have tried to give a general view about this topic.

My efforts and wholehearted co-corporation of each and everyone has ended on a successful note. I express my sincere gratitude to …………..who assisting me throughout the preparation of this topic. I thank him for providing me the reinforcement, confidence and most importantly the track for the topic whenever I needed it.

Abstract:

Ambient intelligence is an emerging discipline that brings intelligence to our everyday environments and makes those environments sensitive to us. Ambient intelligence (AmI) research builds upon advances in sensors and sensor networks, pervasive computing, and artificial intelligence. Because these contributing fields have experienced tremendous growth in the last few years, AmI research has strengthened and expanded. Because AmI research is maturing, the resulting technologies promise to revolutionarize daily human life by making people's surroundings edible and adaptive.
In this paper we provide a survey of the technologies that comprise ambient intelligence and of the applications that are dramatically erected by it. In particular, we specially focus on the research that makes AmI technologies intelligent". Challenges and opportunities that AmI researchers will face in the coming years are highlighted.

Keywords: Ambient Intelligence, Artificial Intelligence, Sensors, Decision Making, Context Awareness, Privacy Reality which is disturbing to many.

Introduction:

Ambient Intelligence (**AmI**) refers to electronic environments that are sensitive and responsive to the presence of people. Ambient intelligence is a vision on the future of consumer electronics, telecommunications and computing t hat was originally developed in the late 1990s for the time frame 2010–2020. In an ambient intelligence world, devices work in concert to support people in carrying out their everyday life activities, tasks and rituals in easy, natural way using information and intelligence that is hidden in the network connecting these devices (*see Internet of Things*). As these devices grow smaller, more connected and more integrated into our environment, the technology disappears into our surroundings until only the user interface remains perceivable by users.
The ambient intelligence paradigm builds upon pervasive computing, ubiquitous computing, profiling practices, context awareness, and human-centric computer interaction design.

Overview:

More and more people make decisions based on the effect their actions will have on their own inner, mental world. This experience-driven way of acting is a change from the past when people were primarily concerned about the use value of products and services, and is the basis for the experience economy. Ambient intelligence addresses this shift in existential view by emphasizing people and user experience.

The interest in user experience also grew in importance in the late 1990s because of the overload of products and services in the information society that were difficult to understand and hard to use. A strong call emerged to design things from a user's point of view. Ambient intelligence is influenced by user-centered design where the user is placed in the center of the design activity and asked to give feedback through specific user evaluations and tests to improve the design or even co-create the design together with the designer (participatory design) or with other users (end-user development).

In order for AmI to become a reality a number of key technologies are required:

- Unobtrusive hardware (Miniaturization, Nanotechnology, smart devices, sensors etc.)
- Seamless mobile/fixed communication and computing infrastructure (interoperability, wired and wireless networks, service-oriented architecture, semantic web etc.)
- Dynamic and massively distributed device networks, which are easy to control and program (e.g. service discovery, auto-configuration, end-user programmable devices and systems etc.)
- Human-centric computer interfaces (intelligent agents, multimodal interaction, context awareness etc.)
- Dependable and secure systems and devices (self-testing and self repairing software, privacy ensuring technology etc.)

History:

In 1998, the board of management of Philips commissioned a series of presentations and internal workshops, organized by Eli Zelkha and Brian Epstein of Palo Alto Ventures (who, with Simon Birrell, coined the name 'Ambient Intelligence') to investigate different scenarios that would transform the high-volume consumer electronic industry from the current “fragmented with features” world into a world in 2020 where user-friendly devices support ubiquitous information, communication and entertainment. While developing the Ambient Intelligence concept, Palo Alto Ventures created the keynote address for Roel Pieper of Philips for the Digital Living Room Conference, 1998. The group included Eli Zelkha, Brian Epstein, Simon Birrell, Doug Randall, and Clark Dodsworth. In the years after, these developments grew more mature. In 1999, Philips joined the Oxygen alliance, an international consortium of industrial partners within the context of the MIT Oxygen project aimed at developing technology for the computer of the 21st century. In 2000, plans were made to construct a feasibility and usability facility dedicated to Ambient Intelligence. This HomeLab officially opened on 24 April 2002.

Along with the development of the vision at Philips, a number of parallel initiatives started to explore ambient intelligence in more detail. Following the advice of the Information Society and Technology Advisory Group (ISTAG), the European Commission used the vision for the launch of their sixth framework (FP6) in Information, Society and Technology (IST), with a subsidiary budget of 3.7 billion euros. The European Commission played a crucial role in the further development of the AmI vision. As a result of many initiatives the AmI vision gained traction. During the past few years several major initiatives have been started. Fraunhofer Society started several activities in a variety of domains including multimedia, microsystems design and augmented spaces. MITstarted an Ambient Intelligence research group at their Media Lab. Several more research projects started in a variety of countries such as USA, Canada, Spain, France and the Netherlands. In 2004, the first European symposium on Ambient Intelligence (EUSAI) was held and many other conferences have been held that address special topics in AmI.

Technologies:

A variety of technologies can be used to enable Ambient intelligence environments such as

Radio Frequency Identification:

Radio-frequency identification (RFID) is the use of a wireless non-contact system that uses radio-frequency electromagnetic fields to transfer data from a tag attached to an object, for the purposes of automatic identification and tracking. Some tags require no battery and are powered by the electromagnetic fields used to read them. Others use a local power source and emit radio waves (electromagnetic radiation at radio frequencies). The tag contains electronically stored information which can be read from up to several meters (yards) away. Unlike a bar code, the tag does not need to be within line of sight of the reader and may be embedded in the tracked object.

Microchip implant (human):

A human microchip implant is an integrated circuit device or RFID transponder encased in silicate glass and implanted in the body of a human being. A subdermal implant typically contains a unique ID number that can be linked to information contained in an external database, such as personal identification, medical history, medications, allergies, and contact information.

Sensor:

A **sensor** (also called **detector**) is a converter that measures a physical quantity and converts it into a signal which can be read by an observer or by an (today mostly electronic) instrument. For example, a mercury-in-glass thermometer converts the measured temperature into expansion and contraction of a liquid which can be read on a calibrated glass tube. A thermocouple converts temperature to an output voltage which can be read by a voltmeter. For accuracy, most sensors are calibrated against known standards.

Sensors are used in everyday objects such as touch-sensitive elevator buttons (tactile sensor) and lamps which dim or brighten by touching the base. There are also innumerable applications for sensors of which most people are never aware.

Software Agent:

Software agent is a software program that acts for a user or other program in a relationship of agency, which derives from the Latin *agere* (to do): an agreement to act on one's behalf. Such "action on behalf of" implies the authority to decide which, if any, action is appropriate.

Related and derived concepts include *Intelligent agents* (in particular exhibiting some aspect of Artificial Intelligence, such as learning and reasoning), *autonomous agents* (capable of modifying the way in which they achieve their objectives), *distributed* agents (being executed on physically distinct computers), *multi-agent systems* (distributed agents that do not have the capabilities to achieve an objective alone and thus must communicate), and *mobile* agents (agents that can relocate their execution onto different processors).

Affective Computing:

Affective computing is the study and development of systems and devices that can recognize, interpret, process, and simulate human affects. It is an interdisciplinary field spanning computer sciences, psychology, and cognitive science. While the origins of the field may be traced as far back as to early philosophical enquiries into emotion, the more modern branch of computer science originated with Rosalind Picard's 1995 paper on affective computing. A motivation for the research is the ability to simulate empathy. The machine should interpret the emotional state of humans and adapt its behavior to them, giving an appropriate response for those emotions.

Detecting and recognizing emotional information:

Detecting emotional information begins with passive sensors which capture data about the user's physical state or behavior without interpreting the input. The data gathered is analogous to the cues humans use to perceive emotions in others. For example, a video camera might capture facial expressions, body posture and gestures, while a microphone might capture speech. Other sensors detect emotional cues by directly measuring physiological data, such as skin temperature and galvanic resistance.

Recognizing emotional information requires the extraction of meaningful patterns from the gathered data. This is done using machine learning techniques that process different modalities speech recognition, natural language processing, or facial expression detection, and produce either labels (i.e. 'confused') or coordinates in a valence-arousal space. Literature reviews such as, and provides comprehensive coverage of the state of the art.

Emotion in machines:

Another area within affective computing is the design of computational devices proposed to exhibit either innate emotional capabilities or that are capable of convincingly simulating emotions. A more practical approach, based on current technological capabilities, is the simulation of emotions in conversational agents in order to enrich and facilitate interactivity between human and machine. While human emotions are often associated with surges in hormones and other neuropeptides, emotions in machines might be associated with abstract states associated with progress (or lack of progress) in autonomous learning systems. In this view, affective emotional states correspond to time-derivatives (perturbations) in the learning curve of an arbitrary learning system.

Nanotechnology:

Nanotechnology is very diverse, ranging from extensions of conventional device physics to completely new approaches based upon molecular self-assembly, from developing new materials with dimensions on the nanoscale to direct control of matter on the atomic scale. Nanotechnology entails the application of fields of science as diverse as surface science, organic chemistry, molecular biology, semiconductor physics, micro fabrication, etc.

Scientists debate the future implications of nanotechnology. Nanotechnology may be able to create many new materials and devices with a vast range of applications, such as in medicine, electronics, biomaterials and energy production. On the other hand, nanotechnology raises many of the same issues as any new technology, including concerns about the toxicity and environmental impact of nanomaterials, and their potential effects on global economics, as well as speculation about various doomsday scenarios. These concerns have led to a debate among advocacy groups and governments on whether special regulation of nanotechnology is warranted.

Biometrics:

Biometrics refers to the identification of humans by their characteristics or traits. Biometrics is used in computer science as a form of identification and access control. It is also used to identify individuals in groups that are under surveillance.

Biometric identifiers are the distinctive, measurable characteristics used to label and describe individuals. Biometric identifiers are often categorized as physiological versus behavioral
characteristics. A physiological biometric would identify by one's voice, DNA, hand print or behavior. Behavioral biometrics are related to the behavior of a person, including but not limited to: typing rhythm, gait, and voice. Some researchers have coined the term behaviometrics to describe the latter class of biometrics.

Architecture:

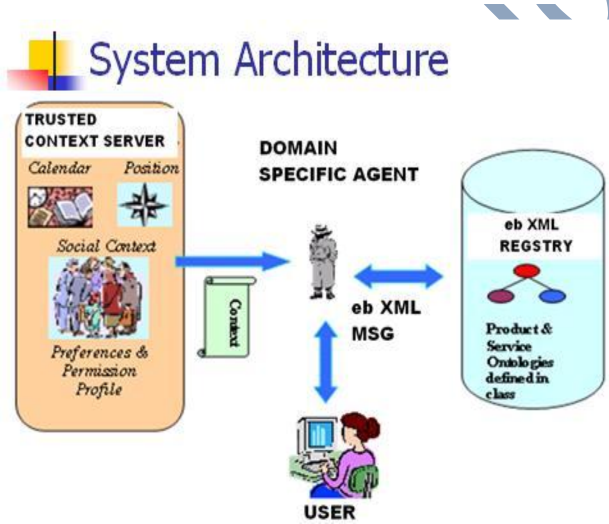
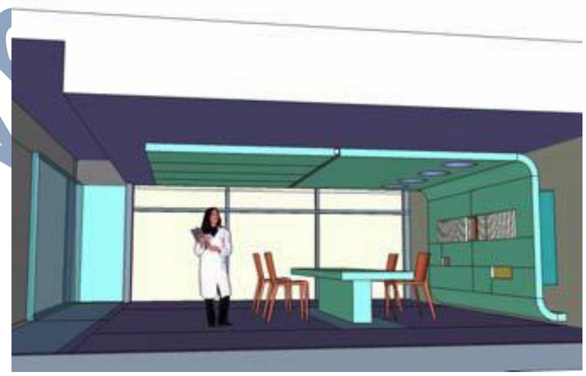


Fig: Ambient Intelligence Architecture

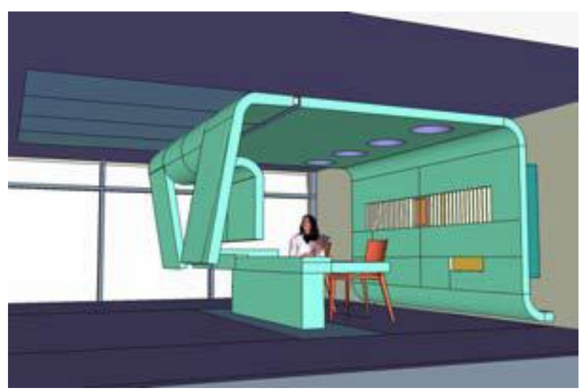
Working Overview:

The ongoing dramatic transformation in working life, including the introduction of ever new digital technologies, presents problems and opportunities to all workers, particularly to segments of the working population that are emerging and neglected: telecommuters, flexible shift workers, single parents, elders, recent immigrants, the obese, the handicapped and, other individuals requiring special accommodations.

This dramatic shift in the nature, place and organization of working life motivates our research which, in the simplest of terms, involves the designing, prototyping, demonstrating and evaluating of a prototypical "robot-room" with embedded Information Technologies that we call an "Animated Work Environment" [AWE] (figures 1 and 2).



AWE concept – SLEEPING



AWE concept - COMPOSING

The strength of AWE is made clearer by recognizing what it isn't: it isn't a building, or a room, or a "stand-alone" device, or a software application, or a piece of furniture. Instead, AWE is a user-friendly, programmable environment, both digital and analog, high-tech and low-tech, fitted to home and office, that users adjust along a continuum, providing the sense of being more "at home" or more "at work," more leisurely or more productive, more efficient or more innovative, while facilitating multiple activities.

In concept, AWE is envisioned as an information-rich environment featuring the ability to continuously "morph" to accommodate a wide range of user needs. At the core of this environment (though not exclusively comprising it) are smooth, continuously deformable "smart" surfaces whose configuration, and hence functionality, are user-controllable. In addition to this novel aspect, AWE embodies a range of "off-the-shelf" Information Technology (IT) components: embedded commercially-available sensors that, when suitably exploited, make AWE user-friendly and intelligent; radio-frequency identification (RFID) tags that allow AWE to associate printed and digital materials; and integrated display screens, scanners, projectors, keyboards and audio speakers that make AWE useful as a total work environment programmable to suit a range of work needs and situations.

Benefit Scenarios:

Scenario 1: Smart Home. The AmI specification may include the Meaningful environment is the house, including the backyard and a portion of the front door as these areas also have sensors. Objects are plants, furniture, and so on.

Scenario 2: Hospital room, where a patient is monitored for health and security reasons. Objects in the environment are furniture, medical equipment, specific elements of the room like a toilet and a window.

Scenario 3: Underground station equipped with location sensors to track the location of each unit in real-time. Based on the time needed to connect two locations with sensors, the system can also predict the speed of each unit. Examples of objects in this environment are tracks and stations. Interactors are trains, drivers and command centre officers. Sensors are used for identification purposes based on ID signals sent from the train. Other signals can be sent as well, e.g., emergency status. Actuators will be signals coordinating the flow of trains and messages that can be delivered to each unit in order to regulate their speed and the time they have to spend at a stop. Contexts of interest can be "delays" or "stopped train". One interaction rule can be "if line blocked ahead and there are intermediate stops describe the situation to passengers".

Scenario 4: School, where students are monitored on balancing their learning experience. The objects within a classroom or play ground are tables and other available elements. The interactors are students and teachers. The sensors will identify who is using what scientific kit and that in turn will allow monitoring of how long students are involved with a particular experiment. Actuators can be recommendations delivered to wristwatch-like personalized displays. Contexts of interest can be "student has been with a single experimentation kit for too long" or "student has not engaged in active experimentation". The first context will trigger a rule "if student has been interacting with one single kit for more than 20 minutes advise the student to try the next experiment available" whilst the second one can send a message to a tutor, such as "if student has not engaged for more than 5 minutes with an experiment then tutor has to encourage and guide the student".

Scenario 5: Fire Brigade has to act then the environment. Streets can be equipped with sensors to measure passage of traffic within the areas through which the fire brigade truck might go through in order to reach the place where the emergency is located. Objects here will be streets and street junctions. Interactors will be cars. Actuators can be traffic lights as they can help speed the fire brigade through. A context will be a fire occurring at peak time with a number of alternative streets to be used. An interaction rule can be "if all streets are busy, use traffic lights to hold traffic back from the vital passage to be used".

Scenario 6: Production Line. Sensors can track the flow of items at critical bottlenecks in the system and the system can compare the current flow with a desired benchmark. Decision makers can then take decisions on how to proceed and how to react to the arrival of new materials and to upcoming demands. Different parts of the plant can be de/activated accordingly. Similarly, sensors can provide useful information on places where there has been a problem and the section has stopped production, requiring a deviation in flow. Objects here are transportation belts and elements being manufactured whilst actuators are the different mechanisms dis/allowing the flow of elements at particular places. A context can be "a piece of system requiring maintenance" and a related interaction rule can be "if section A becomes unavailable then redirect the flow of objects through alternative paths".

Scenario 7: Public Surveillance. Sensors are enriched CCTV cameras on street or on transport, monitored by security guards. Integrators are law abiding citizens and potential muggers. A context can be "if a person is attacked, provide an alarm, issue a verbal warning in-situ to deter attacker and activate a rescue from the nearest police station or security guard". Bidirectional voice channels can be used. Of course AmI requires that the sensing, decision making and actuator are automated. In future this can be achieved with image and sound processing, reasoning for the identification of an emergency situation and text-to-speech warnings delivered to the offender.

Conclusion:

The introduction of AmI in a home environment will have an impact on personal lives in several ways. The time gained will allow people to spend more time with their family and friends. Convenience, money, time savings, security, safety and entertainment reduce the stress leading to an overall higher quality of life. However, the ability to prepare or complete more and more everyday tasks such as shopping or banking at home, potentially leads to reduced face-to-face interaction between people or, at least, to selective interaction restricted to mainly family and friends.
The disadvantage is that every node and the system as a whole need protection.
Research must, therefore, focus on developing user-friendly low-cost solutions with a high level of network security. Managers of the various companies intending to produce and sell AmI technology must agree on common networking standards, which are a major factor determining future success or failure.

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