

Ambient Intelligence: The Future World

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Abstract—Ambient Intelligence, is a technologically advanced environment that is aware of the presence of its user and is sensitive, adaptive and responsive according to its needs but is completely hidden from the user with respect to the technological structure. The basic idea behind AMI is to bring intelligence to our daily life and making our environment sensitive by enriching it with technologies like sensors and other devices which can be interconnected via a network. This paper introduces this whole new paradigm in detail connecting the virtuality to reality.

Keywords: AMI – Ambient Intelligence, Sensors, Internet, Ubiquitous computing.

1. INTRODUCTION

Ambient Intelligence is a new paradigm in the field of computer science that provides minimum explicit interaction of the machine with the user. The deployed technology and the intelligence of the software used for the decision-making largely analyse the achievement of ambient intelligence. Several advances in sensors and sensor networks, Artificial Intelligence, ubiquitous computing have experienced tremendous growth thus, building the Ambient Intelligence research. This research is characterized by the technologies that are embedded, context aware, personalize, adaptive and anticipatory. AmI illustrates an environment where many network devices are integrated and as they are context aware, they can recognize a person's situational context and can be customized according to his needs, thus changing the response according to him.[4].

Since the inception of computer science and engineering, technology richness is continuously progressing, The technologies used for Ambient Intelligence foresee to transform daily human life by making surroundings flexible. Not only the daily human life but the educational domain can also be significantly transformed through AmI by incorporating personalized and adapted learning in place of paper based concepts and prototypes in the real life scenarios[5]. Though, Information Technology has already permeated in the class rooms in many ways, AmI claims to bring remarkable change in the field of education through a sequential Process of sensing, reasoning, acting and Human Computer Interaction (HCI)[1].

Distributed Electronic Intelligence also plays an important role in AMI and helps in hiding the entire hardware from the user eye into the background, thereby leaving the user alone in the

sensing region. Thus, AmI establishes the concept of “Disappearing Computer”[2]:

“The most profound technologies are those that disappear, they weave themselves into the fabric of everyday life until they are indistinguishable from it.”

The idea of a disappearing computer is directly related to “Ubiquitous Computing” or “Pervasive Computing”. By “pervasive” and “ubiquitous” we mean “something which exist everywhere”. Ubiquitous computing focuses on learning by removing the complexity of computing and increases efficiency, while using computing for different daily activities. The aim of this paper is to bring various aspects of Ambient Intelligence from technologies to applications in the knowledge of researchers. The rest of the paper includes the Key Technologies in section II, Ambient Intelligence Services in Section III and the Conclusion in section IV.

2. KEY TECHNOLOGIES

The Ambient Intelligence paradigm includes in itself a large number of technologies, all of which combine together to enable and implement the AmI environment. Also the ongoing research and advancement in these technologies has provided a new light to the AmI environment. Given below is detailed list of technologies that helps in creating the AmI environment[Fig1]:

Radio frequency Identification (RFID) – Radio Frequency Identification technology is used to access the digital information from the physical world without any physical browsing. It makes the use of a wireless system that utilizes radio frequency electromagnetic waves. The system consist of a RFID Tag, which is attached to the object in question and a RFID reader which is placed remotely. The system is used to identify the object and to keep a track of it. The RFID reader transmits an encoded radio signal to interrogate the tag and the RFID tag after receiving the message respond with its identification and other information[6].

Microchip Implant(Human) – A Microchip implant is an Integrated circuit which is implanted in the subdermal layer of the human body to extract various medical information and analyse it on an interval basis. The IC is connected wirelessly with the external world thereby sending and receiving

messages from an external receiver maintain a database of all the results sent by the sensor in the body. The messages received by the receiver can be directly utilized for monitoring purpose by the health care people or can be saved for future references.

Sensors - Sensors are the devices which are used to sense the environment for any kind of change in the ongoing events and produces the output which can either be in the form of electrical or optical signal. In AmI the Sensors are incorporated in to every object to measure the changes in their parameters with respect to the environment and sends them back to the main processor unit for further analysis and proper application of the result[1].

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

Related to derived concepts include intelligent agent (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 in 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: . It is an interdisciplinary field spanning computer sciences, psychology etc. and is basically the study and development of systems and devices that can recognise, interpret, process and stimulate human affects. The more modern branch of computer science originated with Rosalind Picard's 1995 affective computing. A motivation for the research is the ability to stimulates empathy. The machine should interpret the emotional state of humans and adapt its behaviour to them, giving an appropriate response for those emotions.

Nanotechnology: Scientists debate the future implications of nanotechnology. Nanotechnology may be able to create many new materials and devices such with a vast range of applications, such as in machine, electronics, biomaterials and energy production.

On the other hand, nanotechnology raises many of the same issue 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 doomsday scenarios. These concerns have led to a debate among advocacy groups and governments on whether special regulation of nanotechnology is warranted.

Biometrics: Biometrics is the technique which is used to identify humans by their characteristics or traits. Biometrics is used measure to authenticate the identification of a human and

provide access control. It is also used to identify individuals in groups that are under surveillance.

Biometrics involve the use of certain characteristic features of an individual that differentiates them from other individuals and act as their labels for identification. These Biometric features also known as Biometric Identifiers can be physiological or behavioural characteristics. A physiological biometric uses Voice, DNA hand print or Retinal print as an identifier. Behavioural biometrics involves behaviour of a person like typing rhythm gait and voice.

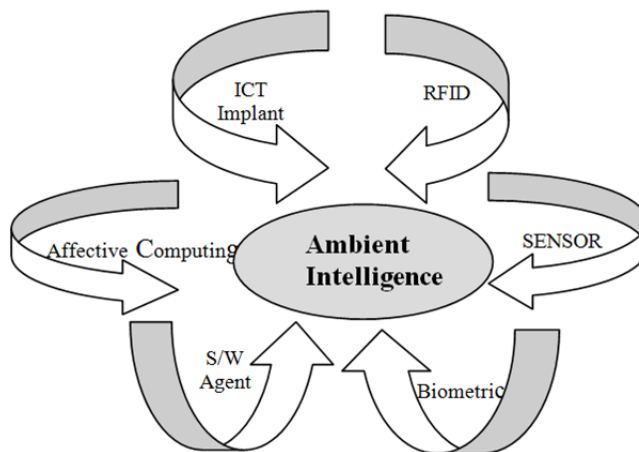


Fig. 1: Key Technologies of Ambient Intelligence

3. AMBIENT INTELLIGENCE SERVICES

This section includes the possibilities of AMI services and discusses few application case studies which can ease humans lives :

Weather Sensing Clothes – This can be done with the help of RFID tags. One's clothes can have RFID tags which contains certain information about weather suitability. The person can have a mobile application which can fetch real time data of weather from a service over internet and then when the person leaves his/her residence, the application could sense the clothes for weather suitability by sensing information available on them and connect the user if it is too cold or too warm for the weather outside[6].

Virtual Fitness Coach – A machine that can contact as a personal coach and can monitor physiological signals which could help people in determining the success of their workout by calculating the intensity of their training[1].

Physical Activity Detection – The movements like slow walking, fast walking, running, getting up and sitting down can be collected by an application. After recognition, system will calculate the total amount of burnt calories throughout the day[4][8].

Smart Education- A smart class room can significantly enhance the educational domain through the learning environment by enriching increasing student access to the

information. Virtual whiteboard is an example of it which can be shared through a network among the students by which they can exchange information or visually attend the lessons[5].

Locating People – Ambient Intelligence can let one notify about the presence of his friends or colleagues in the vicinity. This distance can only be bridged if both the parties use such application and share their context. This can be done with the help of radio technologies like Bluetooth[6].

4. CONCLUSION

Ambient Intelligence is a fast establishing area and has attracted significant attention. Research in this domain is also going at a tremendous pace, sometimes under a different names like “Intelligent Ubiquitous Systems” or “Intelligent Environments”. Different Progresses are being made in the Research fields like Sensor Networks and Context Aware Application, which is a sign of the growth of AmI.

The Strong emphasis of this technology is on forcing computing to reach and serve humans. This may sound as an obvious expectation from computing. But the reality is, much more efforts are needed to enjoy the benefits of computing. As the developments in AmI are user centric, advancements in user interfaces are also required. Still, there are many challenges ahead and improvement in infrastructure, algorithms and human computer interaction are needed, so that the AmI systems can be widely accepted.

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