Chapter I
Ambient Intelligent (AmI) Systems Development

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ABSTRACT

This chapter introduces the concept of ambient intelligence (AmI), a new concept in the area of information and communication technology (ICT), from a systems development perspective in the manufacturing environment. To create an AmI environment, requires the use of a combination of technologies. The AmI environment can be enabled through the use of computers that are embedded into everyday objects and through the use of wireless communication. The interaction between these embedded devices and the human user is improving through advancements in the area of natural interaction. The aim of the chapter is to provide a better understanding of AmI. To this end the following tools are presented, an AmI definition, typology, and taxonomy. The typology solidifies the understanding of AmI by highlighting the elements that need to be considered when developing an AmI system. The taxonomy shows the evolution of technologies towards development of AmI.

INTRODUCTION

The manufacturing environment has changed greatly over the last 20 years and is set to advance even more in the coming years. The Society of Manufacturing Engineers (Koska & Romano, 1988) commissioned a survey in 1988 to consider the changes that would occur in the area of manufacturing in the 21st century. They identified a number of trends. One of these trends was that products would become more sophisticated and the methods used to produce them would become equally as complex. Another was that manufacturing would become more human cen-

tred and a shift in manufacturing towards the customer would occur. These changes that were highlighted in the report are at present taking place in the manufacturing environment. This change process is supported by advancements in the area of information communication technology (ICT).

Ambient intelligence (AmI), a new paradigm in the area of ICT allows for user centred developments and adaptability. However, traditional ICT systems are not capable of this level of accommodation, and as a result a user centred approach that provides adaptability and flexibility is needed. AmI is an advancement of ICT that places the human user at the centre of the technology enabled and embedded environment. The user does not have to make an effort to understand the technologies that occupy the environment but rather the embedded technologies need to be able to express themselves in a way that the user can understand (speech, graphical representation, light, music, and heat). In turn, the embedded technologies need to be able to understand the human (gesture, speech, and body language) as well. Therefore, the AmI system in essence caters for the needs and wants of the human user that occupies the AmI environment. To achieve this level of interaction the AmI system has to possess an understanding of the context and information regarding the user and the environment in which it co-exists. To create this environment, the AmI system therefore needs to have knowledge of the user, process, and environment. The need to incorporate all these elements creates a complex system with elements of hardware and software that need to interact together seamlessly. For the AmI system to be achieved requires the advancement of traditional ICT.

No single technology creates an AmI environment, therefore, a combination of different technologies are used to create the AmI environment. Each technology has unique features and characteristics that it brings to the AmI environ-

ment. With this level of diversity in technology comes with it a complexity. There are numerous technologies that can be utilized; the challenge lies in which combination of the technology creates the desired AmI environment. AmI has many potential benefits as highlighted in the Information Society Technologies Advisory Group (ISTAG) report *Scenarios for Ambient Intelligence 2010* (Ducatel, Bogdanowicz, Scapolo, Leijten, & Burgelman, 2001). The scenarios cover everything from the social, work and home environments in which AmI will exist. In the area of AmI manufacturing, this will involve products and services becoming human-centred, and users will have far greater involvement in the design and development process. Products will be intelligent and they will be able to interact with other technologies, but the human user will control the level of interaction. AmI will allow for the human worker in the manufacturing environment to come to the centre of the production process. Through accomplishing this it will empower the human worker by giving them greater autonomy over their work and environment. The use of AmI will improve decision-making and utilization of resources to enhance efficiency and effectiveness. Therefore, all aspects of manufacturing will be built around the human user.

The aim and objective of this chapter is to provide a better understanding of the AmI concept and by doing so develop tools that can be used in the assistance of its development. To accomplish this, a review of literature in the area of AmI is provided. This reviews the concept, definitions and technologies that enable developments in the area as well as some of the socio-technical implication of the AmI environment. The findings from the literature review led to the development of typologies that can be used in explaining the concept and can be in developing an AmI system. The example of the manufacturing environment is given. The discussion then moves to the future trends in the area of AmI and the impact that this

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