Chapter 8
EPAS: Artificial Intelligent System for Assistance

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1 Introduction

From a general point of view, we define Artificial Intelligent Systems (AIS) machines that behave rationally, according to what says Artificial Intelligence. And we call rational behavior that of a machine, which uses computational models to solve problems. AIS are often Software Systems, in which intelligent machines are computational machines. The Physical AIS are instead those with the ability to perceive, move and act independently, pursuing own purposes and implementing plans to achieve them: they are physical machines that we call Robot.

2 Complex Intelligent Systems

In the meantime gradually are emerging Complex Intelligent Systems, using computational reasoning, able to learn and experience the world through sensors and actuators. Figure 8.1 shows the block diagram of the intelligent behavior of such systems.

The Artificial Intelligent Systems, after a start mostly of industrial applications, begin to affect the life of every day and promise a revolution in the way of life of everyone. The proof is the fact that many laboratories around the world have begun to study and implement AIS capable of supporting the man in his work, household chores, in everyday life, trying to make the machine as close as possible to man in terms of interaction.

The present work introduces the problem of AIS, able to provide a service as close as possible to a human service. Then describes a design of human-oriented

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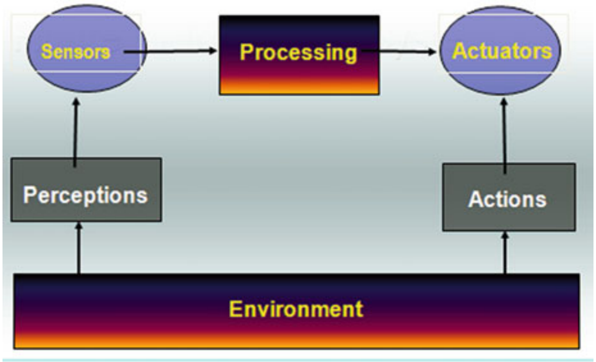

Fig. 8.1: Intelligent system

AIS, named EPAS (Elderly People Assistant System), conceived to support the elderly in their needs [1, 2], like mobility, memory, leisure and health.

Research in the field of intelligent systems is moving towards the creation of humanoids. These will be able to walk on uneven ground in the real world, open close doors with great autonomy, do not lose mobility when they fall.

The Industrialization of humanoid robots is the target in the near future. Meanwhile, there is a tendency towards Intelligent Systems Reliable for everyday life. It is to develop technology-based systems with high reliability, high security functional, with assessment and risk management, able to overcome human error, evolved in terms of 'Physical Human-Robot Interaction'.

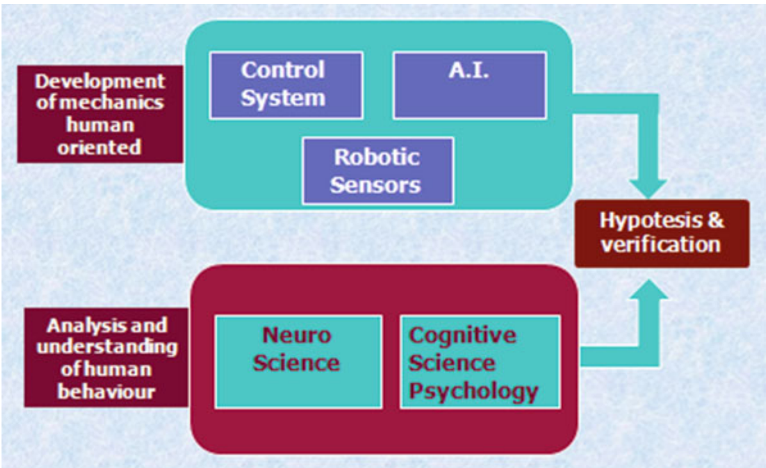

Fig. 8.2: Human oriented AIS

3 EPAS

Build a robot that present human-like behavior is terribly complicated, but fascinating. Being obviously impossible to build a robot that shows human feelings and emotions, we can still make the robot that behaves ‘apparently’ like a human, thus improving our relationship with the machine. We can create robots that read, that recognize objects and interact with the surrounding environment. In designing AIS that interacts in an almost human manner with older people, we have to use, at least in part, the technology of the humanoids. It must be able to interact with humans in a natural way: speak, answer, recognize people, and use human behavior, such as emotional. It must also act as assistant to people who, because of their advanced age, have problems with memory, reading and sometimes mobility. For this last reason, it must be, rather than a biped, an AIS which smoothly moves on wheels, capable of transporting persons and easy to drive, with manual and oral controls. In addition, the cognitive aspects are very important.

To address the problems of appearance and of behavior, two approaches are necessary: the Robotic one and the Cognitive one. The Robotic seeks to build a robot very close to man, based on the Cognitive Science. While the Cognitive Science uses the robot to test hypotheses about human behavior. For both approaches applies the block diagram of Fig. 8.2 which highlights the complexity of the system.

A fundamental property of the android’s science is the existence of the uncanny valley. In Fig. 8.3 it is represented the hypothesis of the “Uncanny Valley”. This says that the degree of confidence between man and robot increases with the appearance and behavior of the human type. But at a certain level of these, the degree of confidence falls sharply.

For example a “zombie” is close to the uncanny valley, as well as the child android, that is often achieved by making a copy of an existing child. The research in this field attempts to verify the existence of the uncanny valley and explore ways of overcoming the problem. Clearly EPAS is far from this valley. It needs to have a pleasant interaction with the elder, so that the machine is well accepted for a large

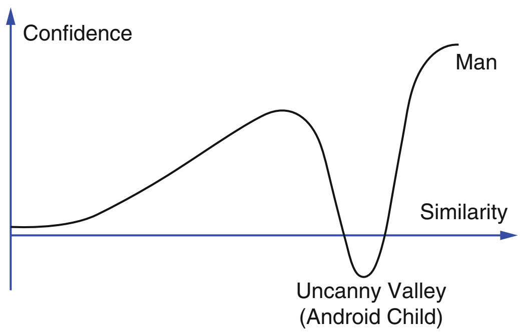

Fig. 8.3: Confidence versus similarity in AIS

proportion of services, done by it, instead of a “human assistant”. The control software of EPAS, called MIND (Monitoring of Intelligence and Demand) (Fig. 8.4) controls the speaking, reading, mathematics, vision, colors, sound, automation and sensors. The control is based not only on manual controls, even on the recognition of sentences spoken, on read the facial expressions and on recognition of 3-D objects. MIND is conceived to interact with the surrounding environment, to process and record the information in its internal memory. EPAS is AIS for elderly people in an indoor environment, in a first version, and in an outdoor environment in a second version. The overall aim of EPAS is to allow independence and autonomy in everyday life for the elderly and disabled. It is designed equipped with man-machine interface oriented to: (1) make it easier and pleasant user interaction with the machine, (2) provide a range of transport services, entertainment, intelligent support to the user who can ambulate or to one that cannot ambulate. It must meet the criteria of “Assistive Technology”, that allow maximum independence to access commands and monitors. Capable of responding to commands: vocal, gestural, or typed [4]. It has sensors able to feel temperature, pressure, etc. and, in general, programmable “alerts”. EPAS is able to detect obstacles in the path; signaling and revealing the fixed and mobile. Launches also sound “alerts”. It is conceived in two versions: one with two wheels and one with four wheels. Both versions use platforms such segway. You can be on board and control the movements with natural movements of the body, using Gyroscopes System platforms. In Fig. 8.4 it is shown the diagram of the MIND [3, 5–10] control software. EPAS has two cameras and a set of microphones. The cameras with intelligent software of vision [11–17] allow seeing the environment and obtaining a map of this. The microphones allow you to localize the sources and then the speaker. The AIS locates sound source, activates the Intelligent Vision System, recognizes the face and tries to approach the user.

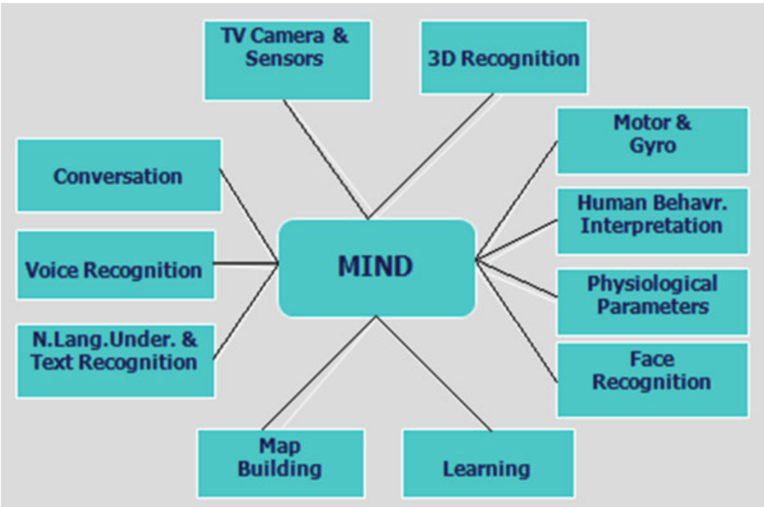

Fig. 8.4: MIND software

Fig. 8.5: EPAS

EPAS is designed to use a platform of Segway type (Fig. 8.5) and able to move around outdoors, overcoming simple architectural barriers. It is endowed of a number of security systems which avoid falls, collisions and hazards. Besides MIND can puts into action a set of strategies and if necessary can stop moving and launch acoustic "alerts" or alarms through a wireless network. Finally EPAS is conceived to be trained, for learning to cooperate [18–20] with other similar AIS, or with humans.Among its equipments, are included entertainment facilities, like playing, listening radio programs, watching TV programs, use of multimedia and Internet.

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