Service Oriented Architecture-robot assisted living

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Introduction

In modern times the average life span of a human being has increased substantially mainly due to the higher living standards. This change brings about new challenges for the area of assisted living and the functionality of relevant living space. Current birth rates are not in tune with the requirements of this aging population, leading to a long-term lack of financial provisions as well as lack of appropriate manpower. The change will have to come from the technological and infrastructural side.

The current changes and redevelopments of the medical and welfare systems are putting additional spotlight on the service providers as well as the general infrastructure for the needy. There is great demand for “reengineering” - both from the customer/client as well from the financier (insurance companies, state pensions, etc.) point of view.

Additionally, with coming of age, owning your own home plays a vital role in the quest of life. There is a strong tendency for the elderly to want to stay in the infrastructure and environment they know.

Technological advancement in the assisted living industry is currently vastly outpacing architectural effort to create effective harmonised living environments. It is important to include these long-term requirements at an early stage of real estate development to overcome higher costs at later stages and possible lack of functionality.

Developments in this area started in the early 70’s. These have constantly been adjusted and redeveloped.

Home Automation (70’s)

Home Automation Systems are offered by most of the well-known major electronic companies, such as Sanyo Denki (Shains) or Sharp (Home Terminal System, House Info System, Home Bus System).

Standard installations consist of the following main functions: Fire alarm, gas leakage alarm, oxygen shortage alarm, electric lock, burglar alarm, emergency alarm, earthquake alarm, guest monitor at door, interphone between rooms, door phone, power control, HVAC control and control of water level and temperature of bathtub.

An example for Home Automation Systems is the Mitsubishi Melon HA System. The Mitsubishi Electric thinks of HA as information orientated home management. Centre piece is the „in house total information system“, which could be complemented by certain additional stages/levels, such as the „household control system“, the „lifestyle information utilization system“, the „house keeping“, the „home management“ and the „life culture“.

Furthermore, there is „fire and crime prevention“, „Energy control“, „environmental and equipment control“, „Data communications“, „health care“, „education and training“, „business and culture“ and „hobbies and entertainment“.

To conclude, this means, that all the things, such as home medical care, home banking, home shopping, home ticket reservation, home employment, electronic mail, home nursing, as well as home studying and tele-control-monitoring can be done without leaving the home.

図7－1　在宅介護の概念構想（作成：黒沢R＆D技術事務所，'85.5，以下同じ）

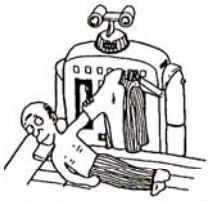


図7－4　身廻り介助（着衣交換）

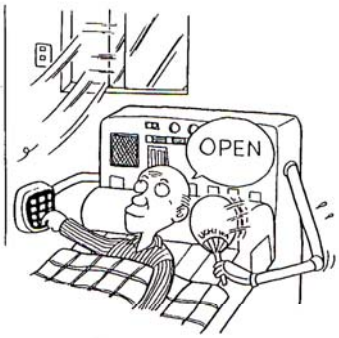
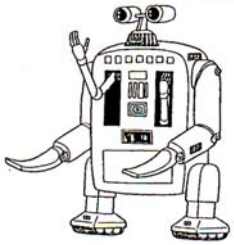
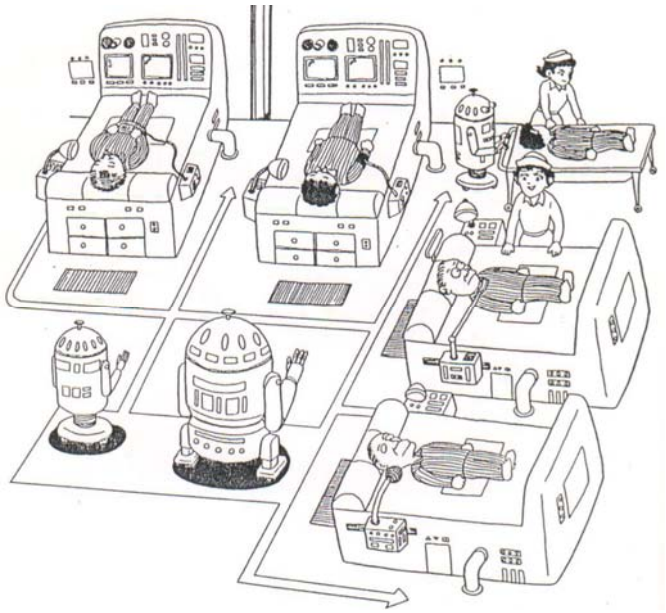
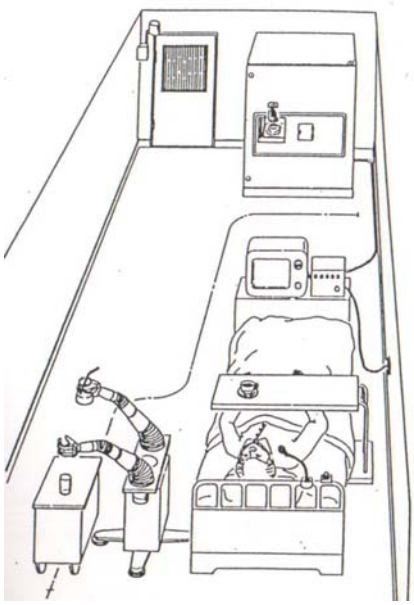


図7－5　環境制御の1例







Sketches showing: Life Support System, developed by Prof. T. Bock, for Japan, Science Society 1986

State of Art of Universal Design

HUD (Housing Urban Development; social housing)

Sekisui House

Picture showing: Products, purchasable at ready-made house construction companies, from a housing catalogue.

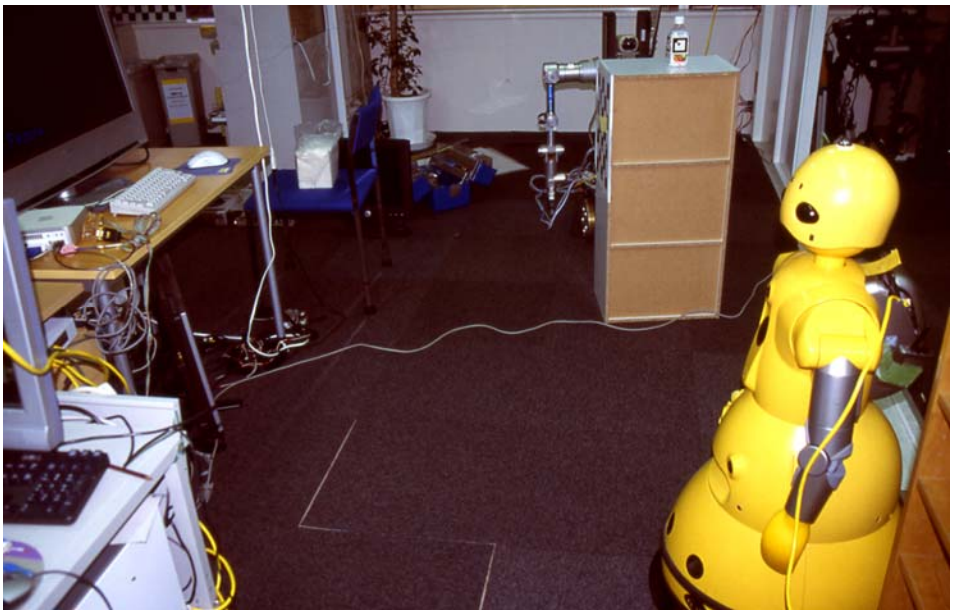
Tron System by Prof. Ken Sakamura (University of Tokyo) (90’s)

Welfare and social Applications:
The application of robotics to medicine in general could be of great help in the area of the patient rehabilitation process.
Robotic techniques, computers and sensors assist patients with sensory handicaps and support doctors with up-to-date computer-aided diagnosis.

Handling and transportation of patients in hospitals:
The pioneering work in this area was conducted by MITI in Japan at the Mechanical Engineering Laboratory (MEL). Here, the feasibility of a patient-handling robot, called „Nursy“ was put to test. In addition, a multidirectional platform was developed with the potential use as a wheelchair for the disabled.

Service Robots in medical Care and social care:
Nursing costs and wages are steadily increasing. There is also a constant lack of nurses. Robots could perform some of these tasks in the future.
Repetitive hospital functions, such as delivering linens, preparing beds, giving medication, transporting patients, monitoring vital signs, supplying the patients with water and food could be automated.

Picture showing: “Meldog” (blind dog) developed by Prof. S. Tachi



Picture showing: “Wakamaru” Roboter developed by Mitsubishi

The “Nursy” system consists of an integrated control apparatus, television camera and monitor, a command device, a robotic arm, a rack and an automatic transport vehicle. The convenience rack is designed as an open bookshelf, which holds various items such as food or books. The items placed on this rack are displayed on the TV monitor. The patient selects items from the menu. These items are then moved to the convenience rack. The robotic arm (with eight joints), puts the selected item onto the vehicle, which is then transported to the patient. The robot assists the patient by holding a book or handling food or drinks.

Photographs: Copyright © by Prof. Dr.-Ing./Univ.Tokio T. Bock

TRON Intelligent house

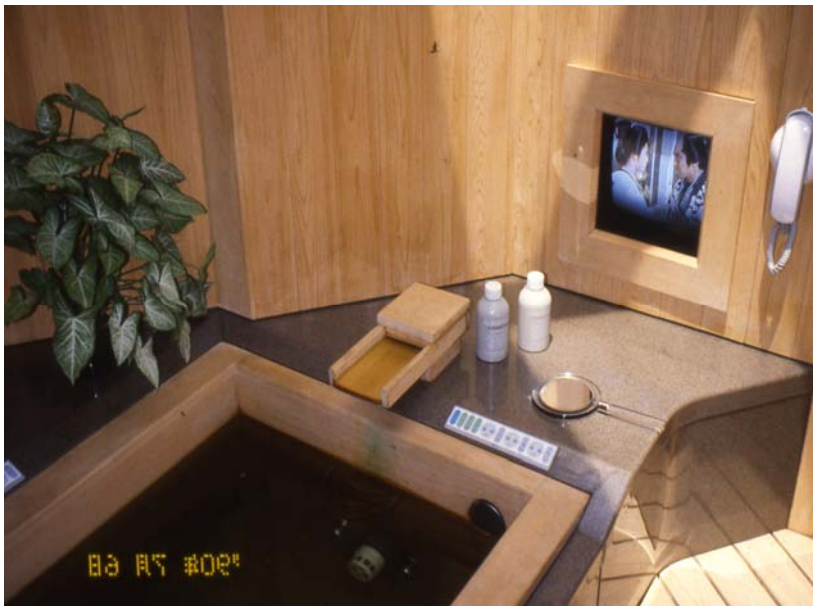
The TRON System by Prof. Ken Sakamura is a real-time-operating-system and the fifth computer generation programme ICOT is likely to have many applications in future construction automation.

This project was started in 1979. In 1981, a committee was set up to envision the information society of the 90's and the requirements of the future computer technology needed for the social development on all levels and with regard to all aspects.
This project supported by the Ministry of international trade and industry aimed at developing a new kind of computer. With the help of the fifth generation computer technology, intelligent robots should support elderly and handicapped people in their daily life.

The goal of the TRON Project has always been to create of a total "computer architecture", so it would be possible to establish a computer-based society in the 21st century. The "TRON Intelligent house" was one of the many TRON application projects that was actually built. The core of the concept was the symbiotic fusion of nature, humans and computers. It was completed in 1989 in Nishi Azabu for a price ticket of 1 billion yen or roughly 7 million €.
At that time, the intelligent house was the most computerized building, with 380 computers interconnected via the TRON architecture. While these computers were able to control every window or door, television, security system, and even the kitchen appliances remotely and automatically, the building itself and the major

amenities were made of traditional Japanese wood material – thus combining Japanese computer technology with the traditional aspects of domestic architecture.

Unfortunately, the Japanese press did not react favourably due to the high costs and the many new features that were so very uncommon for that time. Nowadays, many of these appliances are considered standard or helpful – especially with the elderly in mind.



Picture showing: “Tron” Service Roboter developed by Prof. K. Sakamura

Recent trends

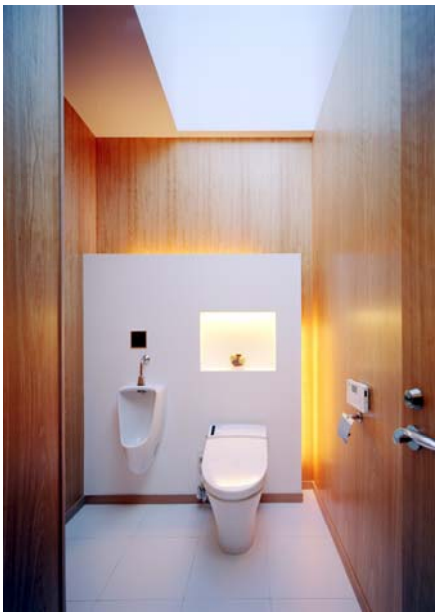
Toyota Dream House PAPI

Ken Sakamura, leader of the TRON Project, in cooperation with Toyota Home K.K., has designed and developed a new intelligent home, based on TRON and other leading edge technologies. The house is called "Toyota Dream House PAPI." It is a new intelligent home and was created to reflect the all-purpose computing technologies that will be available for intelligent home construction in the year 2010.

Toyota Home creates modules to construct homes in factories that are similar to automobile businesses. With this application, Toyota demands that Prof. Sakamura learns about modular home construction techniques and adapts his design accordingly. That is why the company fully intends to bring the technologies on the market after they become commercially feasible.

The main objective of this project was to create and realize an environmentally friendly, energy saving, intelligent house design in which the latest network computing technologies developed by the T-Engine project could be tested and further developed.

The Toyota Dream House PAPI is situated near the Toyota Museum in Aichi Prefecture, which is 3,500 square meters in size. The total area of the house is 689 square meters. The house is mainly made of recyclable materials such as glass and aluminium. There is no need to clean the large glass windows regularly because of a special self-cleaning coating. In addition, Toyota Dream House PAPI possesses the technology along the lines of TRON to secure communication between the nodes. Nano T-Engine and pico T-Engine are used to make the construction of the nodes easy. The respective network is fairly sophisticated. The Ubiquitous Communicator (UC) identifies people moving through the computerized living space and their personal preferences can be recognized. Though, the UC is only one of many HMIs, which can be used in the Toyota Dream House PAPI.



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