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HUMANOID FRIENDLY ROBOTICS

There are a number of reasons to be interested in design, building and application of humanoid type robots [1].

One of the main reasons is the growing percentage of the Elderly, which become a high part of population in some countries like Japan, Italy, Sweden, UK, and U.S.A. Many of Elderly need on everyday help.

With the arrived of an aged society right ahead of us, the expectation is high for personal use robots to accomplish such objectives as supports (or homework within homes and supports for providing care for the elderly and handicapped people [2]. This paper presents some ideas concerning humanoid robotics projects including KANSEI information processing. KANSEI is a Japanese world to express some subjective concept like "sensibility", "emotion". "Kansei" plays nowadays an important role in robotics [3].

PRZYJAZNE ROBOTY HUMANOIDALNE

W ostatnich latach prowadzone są badania w zakresie projektowania, budowy i zastosowań robotów humanoidalnych. Jedną z przyczyn jest rosnąca liczba ludzi w podeszłym wieku wymagających stałej opieki.

W referacie omawia się pewne zagadnienie związane z koncepcją współpracy człowiek–robot partner.

1. AGED SOCIETY PROBLEMS

In result of the improvement of the level of life and health care the average age of the people in some countries strongly increased. For example in Japan the average for man is 78 and for woman 84.

Figure 1 presents the percentage of the elderly people (over 65 years) in the whole population as a function of time [4].

This situation, in 2015–2020, will create a new situation concerning the health care of millions of elderly people. Classical medical care looks rather impossible. That is the reason that many researches are now working on two kinds of supporting devices namely humanoids and personal robots.

The first concept is oriented for human – like robots equipped with "kansei", the second based on personal robot not necessarily similar to human. In the both cases the robot should be like a partner for the disabled person at home and ensure robot–human friendly interaction.

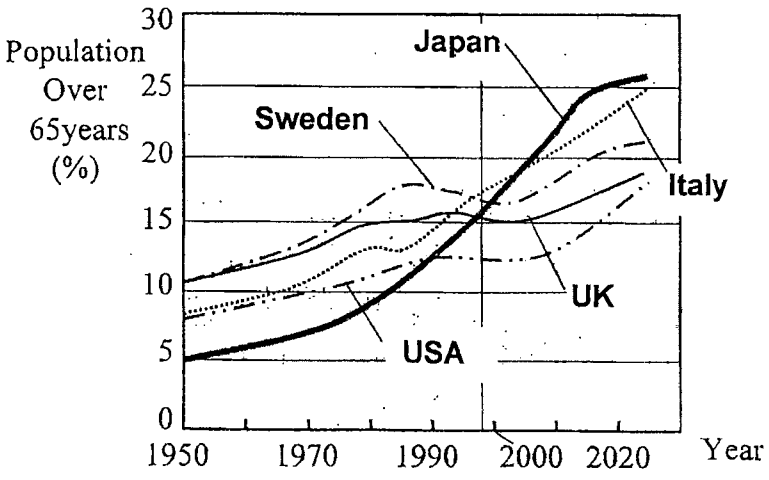


Fig. 1. Percentage of the elderly [4]

2. PRESENT STATE OF RESEARCH

In many research centres all over the world we observe an intensive development of both kind of friendly robots, especially in Italy, Japan, U.S.A., Germany.

Will shortly discuss some selected examples of such robots.

In Italy a group headed by P. Dario is working on robots for personal use [5] (personal assistants, servants, companions).

In Japan (Waseda University) a group headed by A. Takanishi concentrated on the development of humanoid robots with head with antonymous facial expression mechanism [6].

AIST has launched a platform–based humanoid robotics project. The platform consists of a humanoid robot, a remote cockpit to control the robot and an equivalent virtual robot [7].

In Korean Institute of Science and Technology, a humanoid robot system called CENTAUR was designed and tested [8].

NASA is developing an advanced Humanoid System called Robonaut [9].

As it was mentioned before at Waseda University [2] a number of human friendly robots were design. Humanoid project started in 1992. In 1995 the first experimental robot "Hadaly" was produced. In 1997 two humanoid robots Hadaly–2 and WABIAN were designed [12]. Hadaly–2 (170 cm, 180 kg) moves with wheels. WABIAN (166 cm, 107 kg) is a biped walking robot (Fig. 2).

A group headed by R. Dillman developed the humanoid robot ARMAR [10]. Some selected examples discussed shortly above show the growing interest in the development of human–like friendly robots.

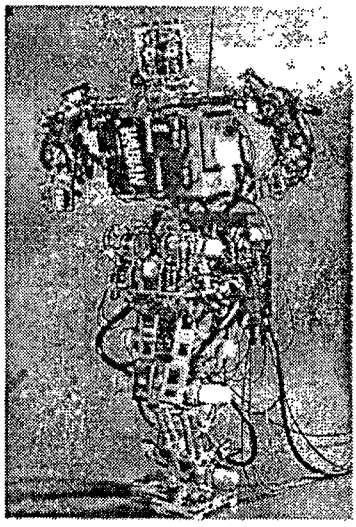


Fig. 2. Humanoid robot WABIAN [12]

3. MITI's HUMANOID ROBOTICS PROJECT [7]

Will shortly describe the main good of this project. This project is run from 1988 to 2002. The platforms (Fig. 3) is developed in phase one (two years) and its applications in phase two. The total budget for the first two years is about 2 billion JPX.

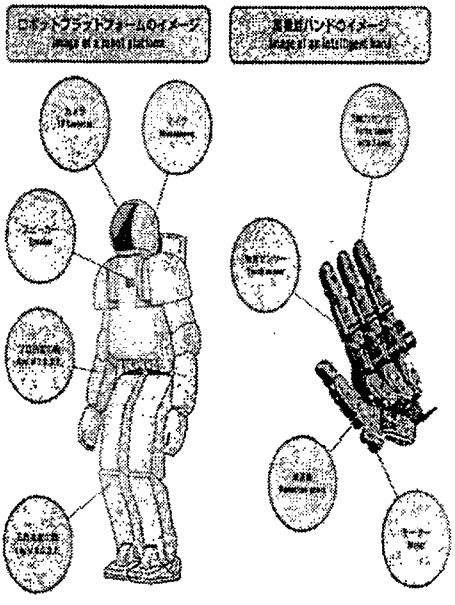


Fig. 3. Image of robot platform [7]

Figure 4 shows the examples of the applied technology for a humanoid and human friendly robot [7].

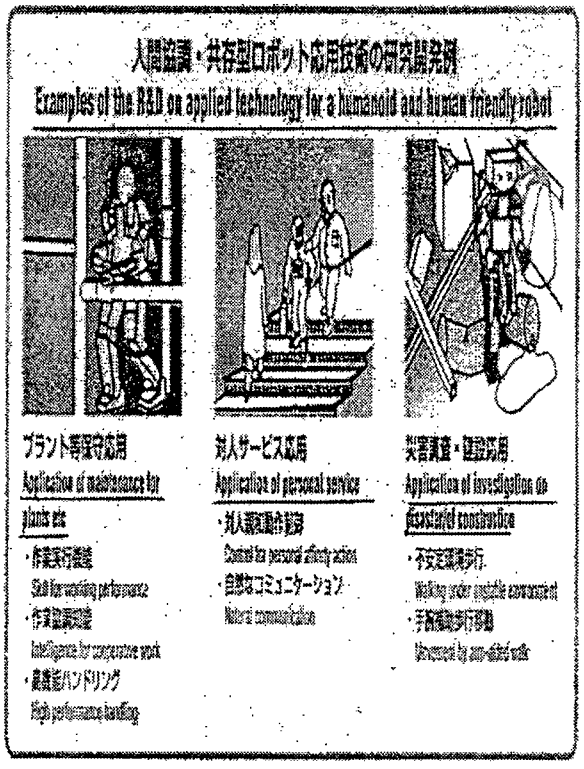


Fig. 4. Example of the possible applications [7]

4. KANSEI SCIENCE

The term "human factor" has a close relation with "Kansei". However, in the Kansei information processing, we intend to approach the human emotional world more positively by applying computer technology to the emotional information processing and human communication including art and music [3]. The computer is often said not to have the Kansei. The reason is that the computer seems to simulate the logical aspect of human behaviour but not the Kansei aspect so far. The Kansei information has some different characteristics from the logical information such as the subjectivity, multivocality and ambiguity.

„Kansei" is a Japanese word to express some subjective concept like "sensibility", "sensuality" or "emotion" (Fig. 5). Recently, "Kansei information processing" has become a popular term among Japanese researchers in computer science. As they could not find a suitable English term for Kansei, they could not find a suitable English term for Kansei, they decided to use "Kansei" without translation in writing English papers. The Kansei is sometimes a contrast to logical intelligence. It means a sort of human ability of understanding. The Kansei includes some psychological universality and individuality at the same time [2].

感[kan]

a feeling, sense,
sensation, emotion

性[sei]

nature

Fig. 5. "Kansei" science

Another field where the Kansei plays an important role is robotics. Since the robots in the next century will be operated within a residential environment built primarily for humans, it is necessary for the robots to have configurations and functions that are suited for residential environments. Moreover, the robots will be engaged in their operations in collaboration with the users. Therefore, smooth communication with humans will be indispensable. This means that the physical behavioural space and the information related mental space of a robot should have a high compatibility and permeability with those of a human. Especially, emotion is one of the most important factors that has crucial influence on the success or failure of communication in our human community. Therefore, if the robot had the same Kansei (intelligence, emotion, and will) as human it would be far easier for robot to perform the co-operative works with human.

Many people expect that as we move toward the 21st century, a variety of human friendly machines and robots will be developed and broadly utilised in primary and tertiary industries. With the arrival of an aged society right ahead of us, the expectation is high for personal use robots to accomplish such objectives as supports for housework within homes and supports for providing care for the elderly and handicapped people [2].

One of the important problems is the head function of the humanoid robot for the natural communication between human. Different kinds of head movements are also important. The further studies on human motion are necessary [11].

Takanishi [6] and his group developed three humanoid head robots WE–3, WE–3R, and WE–3RII to realise the natural human–robot communication. WE–3 realised the VOR motion in 3D space by co-ordinated control of the eyeball and neck simultaneously. WE–3R realised the adaptive eyeball neck behaviour to the brightness of the target by using the eyelid mechanism. WE–3RII realised a human–like 6 facial expression (happiness, anger, surprise, sadness, fear, disgust) and neutral face by using a 3–axis psychological model and facial expression mechanism (Fig. 6a,b).

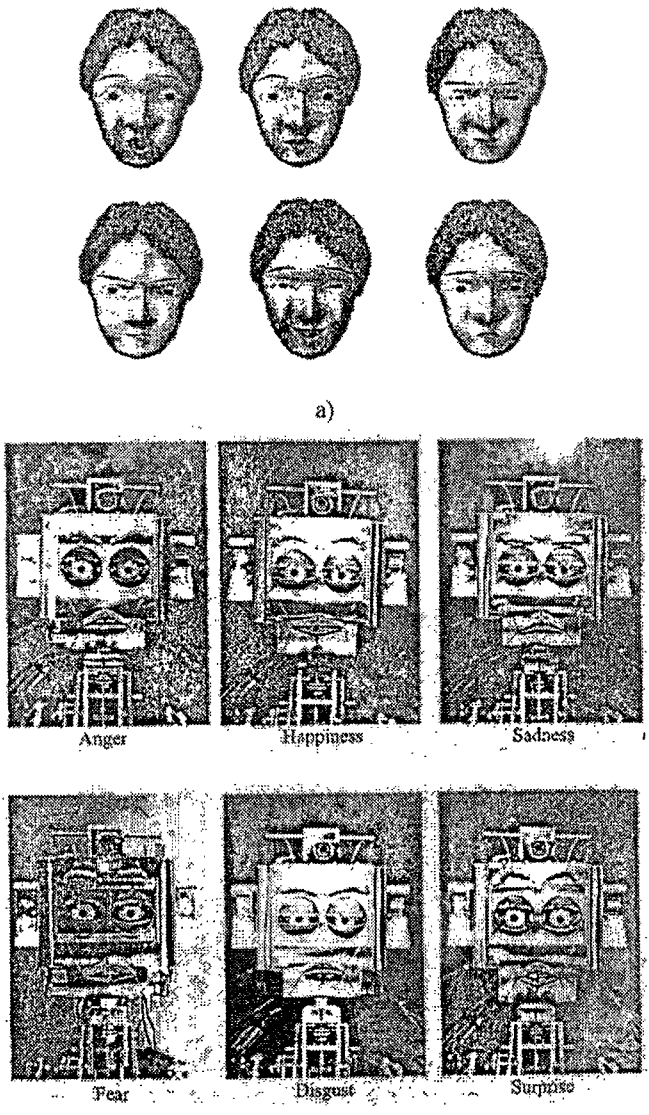
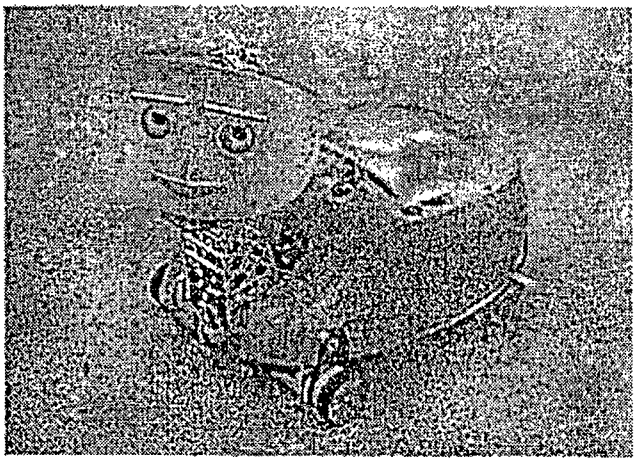


Fig. 6. The six basic facial expression [6] a) in human, b) in robot

The authors are developing a new humanoid head robot WE–3RIII which has the sense of cutaneous (touch and temperature) added to visual and auditory senses in WE–3RII, and an improved facial expression mechanism. The authors would like to present its development and experimental results in the near future.

Parallel to the development of human friendly robots some researches are working on human friendly animals (Fig. 7). This figure shows so called Aibo produced by SONY.

a)



b)

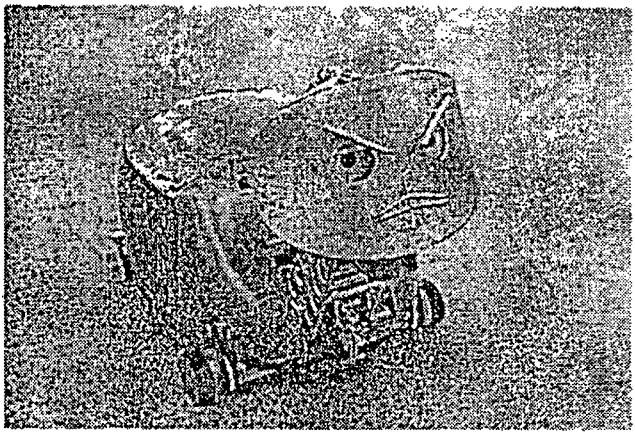


Fig. 7. Aibo: a) happy, b) anger [2]

5. CONCLUSION

In this paper some problems concerning the so–called human–friendly robotics were discussed. Some examples of current projects running in Japan, Italy, U.S.A., Germany are presented. The idea of so–called Kansei science offered for robotics was given.

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