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Biofied Building for Active and Healthy Ageing using Sensor Agent Robots

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Abstract

This paper presents a concept of new building system learning from adaption mechanisms of living things to support senior citizens who wish to stay in their homes for as long as possible. Sensor agent robots are used to improve their quality of life to curtail their potential risks associated with poor health, cognitive impairment, frailty and social exclusion. This system will help our society by reducing the number of care houses and care staffs as the senior citizens can stay in their homes for as long as possible. The "biofied building" system fully exploit the resources of the senior citizens themselves to extend their happy lives with the help of sensor agent robots.

Lifelogs of the senior citizens are the most important elements of this system to identify their physical, social, mental and emotional status so that necessary actions are to be taken properly by embedded devices or telling the status to their family and/or care staffs. Unique aspect of this biofied building lies in their adaption mechanisms embedded. The adaption mechanisms consist of sensory adaption, adaption by learning, physiological adaption and evolutional adaption. The lifelogs are stored into a cloud server to be used for learning and discovery. Among the adaption mechanisms, we especially focus on physiological adaption and evolutional adaption as they are indispensable mechanisms for all living things. Without these mechanisms, none of them had not survived in harsh environments.

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Keywords: robot, ageing society, sensor agent

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1. Introduction

The number of senior citizens living alone is drastically increasing in Japan. This is partially due to the change of our social systems and preferences. Just several decades ago, big families were common everywhere in Japan so that we rarely see senior citizens live alone. However, most of those senior citizens do not want to live together with their children as they want to keep their own lifestyles. Their children as well do not want to live with their parents in most cases but worry about the potential danger associated with their parents' loneliness. The biofied building presented here is intended to resolve some of those issues associated with senior citizens living alone.

Lifelogs of the senior citizens are useful to identify their physical, social, mental and emotional status so that necessary actions are to be taken properly by embedded actuators or telling the status to their family and/or care staffs. A unique aspect of this biofied building lies in their adaption mechanisms. The adaption mechanisms consist of sensory adaption, adaption by learning, physiological adaption and evolutional adaption[1]. The lifelogs are stored into a cloud server to be used for learning and discovery. Among the adaption mechanisms, we especially focus on physiological adaption and evolutional adaption as they are the key mechanisms for all animals. Without these mechanisms, no animals had not survived against harsh environments. There are strong demands for buildings that are

- ✓ safer and more comfortable,
- ✓ energy-saving,
- ✓ sustainable for many years,
- ✓ satisfying individual needs,
- ✓ and supportive for aging and handicapped people.

A solution satisfying the above demands is evolving a building smart using many sensors, computers and actuators. However, smart houses or buildings involving such devices proposed previously are mostly based on scenario-based control systems. Thus, the systems are not so flexible to adapt to a new generation of technologies and is not able to deal with unexpected events that were not written in the scenario.

We propose the use of sensor agent robots to minimize installation of sensors into building spaces. The sensor agent robots will be pets for residents. As they are self-contained systems, they are portable to be used at any building spaces. When the robots become degraded, they will be replaced by new robots while the data taken by the old robots will be inherited to the new robots. Thus the whole system can be always up-to-date by only keeping the robots to be new. In this paper, research activities on biofied buildings currently conducted at our laboratory are briefly summarized. We are particularly interested in homeostasis control[1] and design by genetic algorithm.[2] They are new and have great potentials to evolve building systems drastically. Those mechanisms do not require scenarios. Illustrations.

The biofied building system fully exploits the resources of the senior citizens themselves to extend their happy lives with the help of sensor agent robots. The image of a living room supported by a sensor agent robot is illustrated in Fig. 1. This figure was prepared for our proposal to the Ministry of Education, Culture, Sport, and Technology in Japan. Fortunately, this proposal has been successfully approved to start a three year (FY2015-2017) research project on sensor agent robots supporting elderly people. In this project, the sensor agent robot lives together with an elderly person as a pet while constantly acquiring lifelogs. Using the adaption mechanisms, the room environment is controlled to keep the room comfortable. If an emergency situation happens, the sensor agent robot will immediately notify the situation to registered people such as helpers and family members.