



# The Application Trend of Smart Sensing Technology in Home of Building:

## An Example of a Green and Smart Building for the Seniors Citizens Offered by Farglory Land Development

**Meng-Hsien Hsieh**

*Industrial Economics & Knowledge Center, Industrial Technology Research Institute, Taiwan*

(Received 15 July 2011; Published on line 1 September 2011)

Corresponding author: [stevenhsie@itri.org.tw](mailto:stevenhsie@itri.org.tw)

DOI: [10.5875/ausmt.v1i1.95](https://doi.org/10.5875/ausmt.v1i1.95)

**Abstract:** The living space of smart buildings requires three major applications: energy-saving and comfort, security and hazard prevention, and health care. These applications not only give rise to a market opportunity for advanced sensor fusion technologies including comfort sensing, infrared sensing, inertial sensing, and voice recognition, but also make proactive sensing, smart determination, and automatic control possible. The smart building project by Farglory Land Development, where senior citizens are able to live comfortably and be well taken care of, is presented here. The current trends visible from this project are also discussed.

**Keywords:** three-in-one comfort sensor; inertial sensor; sensor fusion.

### Introduction

The rapid rise of the Internet of Things and cloud computing has propelled the development of smart buildings worldwide. In Taiwan, the advancement of Information and Communication Technology (ICT) and sound government policies are encouraging the launch of more smart buildings. Looking ahead, smart buildings will not only improve a consumer's life quality, but are also expected to encourage the emergence of more advanced sensor fusion technologies that in turn creates ample market opportunity.

### Definition of smart buildings

According to the Architectural and Building Research Institute of the Ministry of the Interior, smart buildings are defined as buildings equipped with a Building Automation System (BAS) that aligns with the space and physical components of the building while integrating ergonomics, the physical environment, operation type, and managerial style. The system

automates the functioning and maintenance of facilities in the buildings, including the electricity, telecommunications, water supply and drainage, air-conditioning, hazard prevention, theft prevention, and transportation. It boosts the functionality and quality of the buildings and, as a result, serves the purpose of providing safe, healthy, energy-efficient, convenient, and comfortable housing for their inhabitants.

Dr. Tech. Per Christiansson of Aalborg University, Denmark defines intelligent buildings as buildings which, through their physical design and Information and Communication Technology (ICT) installations, are responsive, flexible and adaptive to changing needs from its users. These ICT systems and functional sub-systems are integrated and embedded in the building to provide users with comfort and security.

Parsons Laboratory of the Massachusetts Institute of Technology defines smart buildings those using sensor networked technology, embedded within the architecture to monitor and control elements of the architecture for exchange of information between users, systems and buildings.



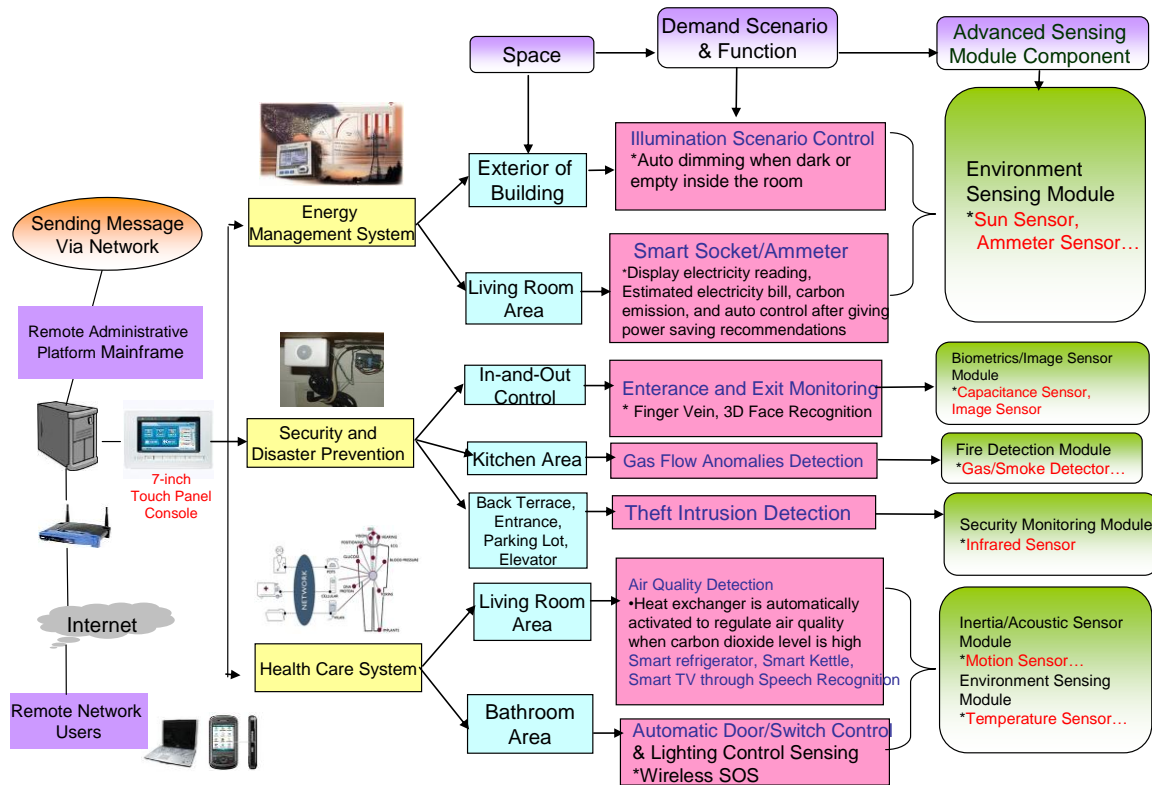


Figure 1. Case study of green and seniors’ smart building by Farglory Land Development [1].

The above definitions point to key commonalities of smart buildings. Specifically, the physical ontologies or living spaces are embedded with advanced technologies such as multi-sensing, embedded computing, and sensor-networking to meet end-user needs and requirements for comfort, security, hazard prevention, and health care.

### An Anatomy of Farglory Land Development’s Project

A smart building project for senior citizens launched by Farglory Land Development, a leading real estate developer in Taiwan, features the installation of an advanced sensor fusion scheme to implement proactive monitoring, smart determination, and automatic control, as shown in Figure 1. [1] As a result, the occupants are therefore well taken care of around the clock under the sophisticated system.

For energy conservation and comfort, the housing compound introduces a home energy management system and T5 automatic dimming tubes that come along

with ammeter sensors and smart lighting and sensing components. The residents are able to achieve wise use of electricity by leveling off power consumption, as the system optimizes energy use in home lighting in response to illumination and sunshine, and displays real-time information of electricity consumption as well as timing analysis on embedded touch panel.

As to promote security and prevent disaster, highly sensitive infrared sensors, connected to anti-theft alarm system, are installed in blind spots of terraces in the back of the residence, so as to monitor intrusion.

In terms of health care, the residence has a three-in-one environment sensing module for detecting temperature, humidity, and carbon dioxide concentration. A heat exchanger is automatically activated to regulate air quality as soon as the carbon dioxide concentration indoors exceeds the safety levels set by the EPA for a certain period of time. The security system will be triggered at the same time to go on on-site patrol and give human support.

In addition, the building integrates the embedded system with home appliance sensing applications, including intelligent video surveillance, fingerprint access control, smart TV with voice recognition function, smart kettles, and smart refrigerators. The entrance and exit and appliance usage of the residents are monitored to determine any irregularities. If irregularities are found, emergency measures are taken instantly and accordingly.

**Meng-Hsien Hsieh** is a Researcher in the Electronics and System Research Division at IEK/ITRI (Industrial Economics and Knowledge Center/Industrial Technology Research Institute). He received his Master’s Degree from the Department of International Business Soochow University, and in charge of connector and sensor related area research at key components and materials research department.



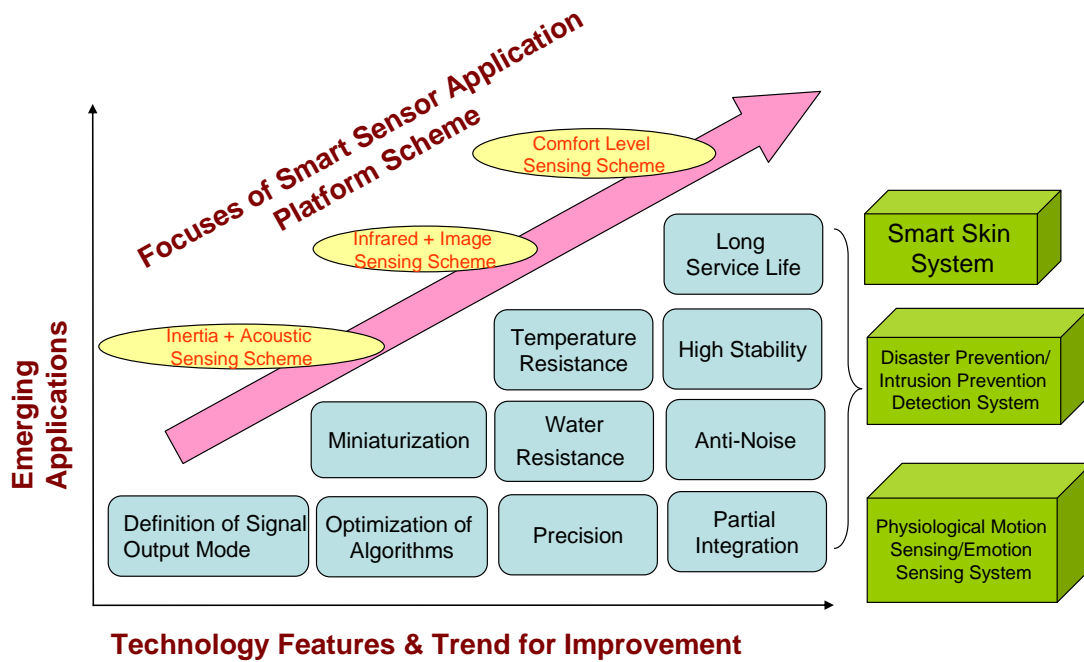


Figure 2. Sensing technology trends of smart buildings and home application.

## The Trends of Advanced Sensing Technology Arising from Smart Housing

Farglory's project reveals trends of advanced sensing technology related to future living space (see Figure 2). One example of this is the adoption of integrated multi-sensing solution, such as the three-in-one sensing module capable of detecting temperature, humidity and carbon dioxide level. It is expected to be further fine-tuned to include an anemometer, sun sensor, and blackbody radiometer to satisfy inhabitants with diverse demands for energy-saving, security, and care. This solution relies heavily upon advanced heterogeneous integration and packaging module technologies. Furthermore, the integrated module is likely to move toward miniaturization and a lower cost.

Another trend that can be seen in Farglory's property is the optimization of software and algorithms. Future sensing technology, in addition to continued improvement of effectiveness, is expected to rely more on fine-tuning software to match user behavior models. Consequently, the functionality will be more friendly and convenient to users.

Finally, another trend is to ramp up environmental tolerance of the module. When the sensing technology applications of smart buildings become more popular and mature in future, they are expected to be utilized beyond their existing interior and exterior spaces of buildings and into furniture and public areas such as stairwells, elevators, and parking lots. As the applications are stretched in terms of areas of coverage, the module

consequently requires being more resistant to weather conditions. The environmental tolerance of the module, therefore, ought to be improved to meet the requirement for longer service life.

## Conclusion

If intelligent sensing is to be truly realized, the multi sensing module must be incorporated into a micro controller. Massive amounts of gathered data will go through digital processing and then pass through sensing networks onto a back-end administrative platform for further analysis. Combed with scenarios and priorities set by the system, results of the analysis will then be turned into contingent action plans, allowing the residents to enjoy a high quality of life feeling at ease and secure, all the while saving energy. As such, the synergy of smart building technology and home application can be accomplished.

## Reference

- [1] G. L. Ma, "Endow Buildings with Life-Sharing and Discussing Successful Cases of Smart Buildings," presented at *Conference on Endow Buildings with Life-Green Structures, Green Building-Material, and Building Intelligentization* (organized by Industrial Economics & Knowledge Center, Industrial Technology Research Institute), Taipei, Taiwan, March 16, 2011. Available: <http://www.touchlife.com.tw/upload/combo/20110414133051673997120.pdf>