

# Development of Education System with Intelligence Home Automation

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## Abstract

We have studied the methods to connect homes with a digital network and apply home automation to education. We presented the possibility of integrated education where public education at school can be extended to home. The hardwares related with home automation are continuously in development. We have demonstrated the materials appropriate for the levels of individual students with home network information, and studied methods of education.

*Key words: Education System, Intelligence Home Automation, Digital Network*

## I. Introduction

Recently, it is getting more serious about the educational status which many ordinary students face. Most of them may be due to the world-wide network. The general trends of society have the keyword of “convergency”. Even the students at elementary

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schools can send and receive digital packets with ease. Therefore, it is getting more urgent to find the solution in : (1) appropriate utilization of network resources, (2) management and administration of distributed data and so on. At this point, many networks may be combined together to reinforce their function and value. They may recognize various circumstances and give the solution to many problems. We do not have to develop difficult computer languages and do not have to learn professional knowledge. They can be extended to other software. Thus, more security services are supplied every day. Now, all the fields have become digital. We can enjoy entertainment, watch HD-TV without wires, investigate every aspect with a remote control, and share digital photos and music files. Life has become more fluent. In this study, we tried to develop content which can support public education with digital photos, music data, stored TV programs, games, and laptops. We studied the methods to apply PAD, laptop, PDA and cellular phones to education. At last, we suggest the solution to the problems of mobile schools and public education.

## II. Results and Discussion

### 1. Design of home automation system

The protocol of home automation system is shown in Fig. 1, and main equipments of the system are in Fig. 2.

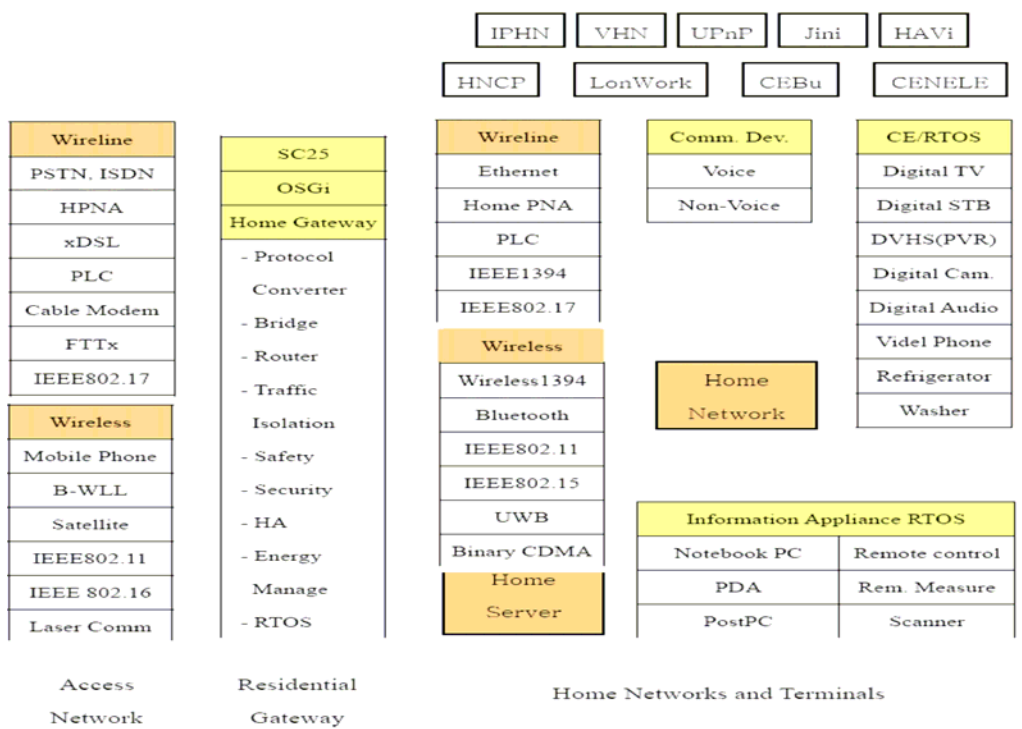


Figure 1. Main components of home net work

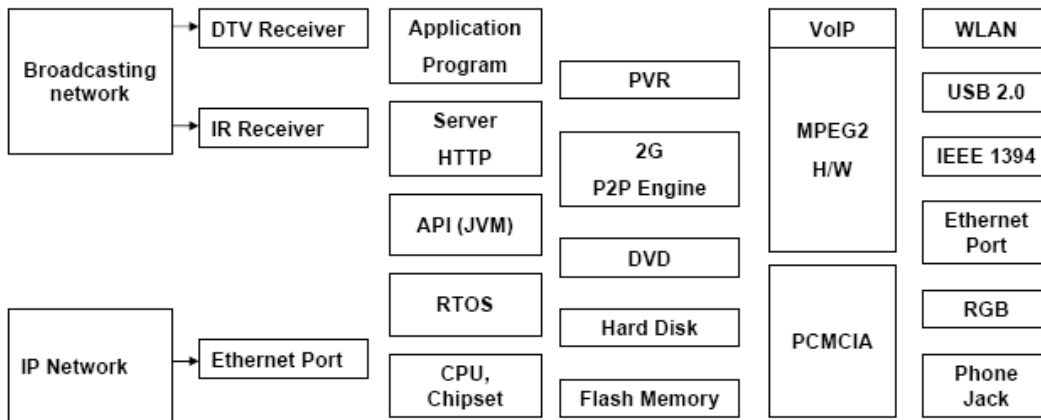


Figure 2. Instrumentation for home net work

The instrument for P2P related with remote control is in Fig. 3

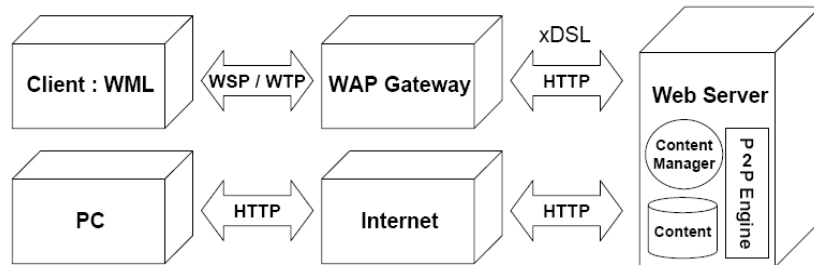


Figure 3. Main equipments in home network

The IPv6 are in Table 1.

Table 1. List of IPv6

Classification	Details
VOIPv6	Application of embedded system assigned to certain IPv6 address
IPv6 remote healthcaresystem	Measurement of the patient's condition with body signal detector, and remote Healthcare service by a doctor with IPv6 PC
IPv6 web camera	Development of network camera based on IPv6 Home monitoring with IPv6 network
IPv6-P2P	Share the IPv6 address in the form of global naming to each peer

The home viewer provides the moving picture and enables the daily inquiry and has the function of deletion or movement of data files. It can be connected with web browser and processed and be remote-controlled. An example of home viewer is in Fig. 4.



Figure 4. An example of the application of home viewer

The universal plug and play (UPnP) is shown in Fig.5

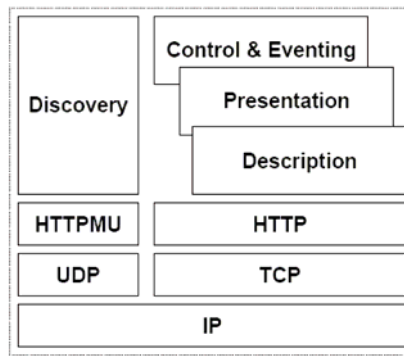
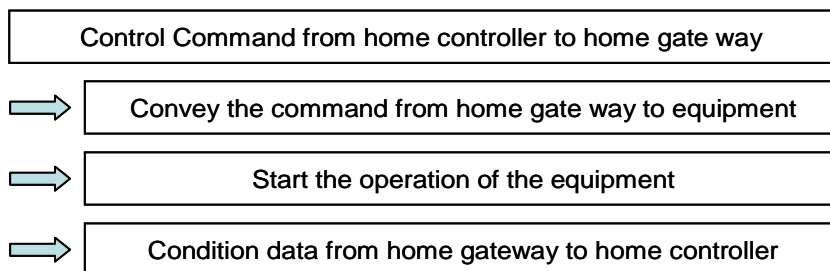


Figure 5. The layout of UPnP

The example of the application of this home network is as following.

1. Control of illumination, blind, air conditioner, boiler, washer, oven



2. Control of gas valve

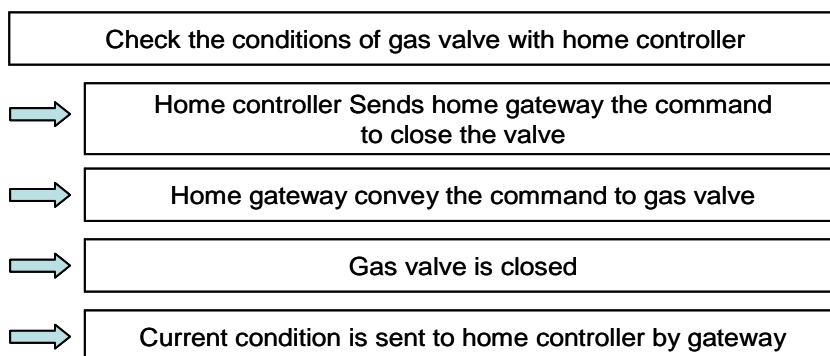


Figure 6. An example of the application of home network system

## 2. The function of home automation system

As shown in Fig. 7, remote control and monitoring through internet requires home gateway with web server, and instrumental network of the target equipment. Home illumination, heat stove and electronic products are equipped with microprocessors which support an RS-232C serial communication port to enable the connection to home gateway. In the situation where it is difficult to make additional wiring, it is possible to use small power cable communication or wireless communication modem for a home gateway. However, the target instrument should have network interface and be connected to embedded home gateway accessible through internet. It should get a fixed IP address as a web server.

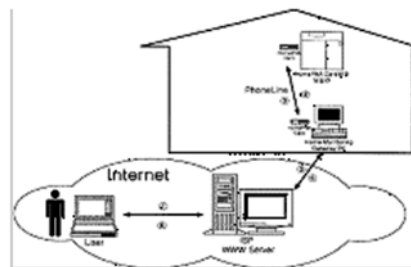


Figure 7. Internet control and monitoring

For a convenient life, it is required to use a portable terminal which can be used to operate home automation without wiring. In the past, video phones used the hot key of 900 MHz wireless phones to open the door and turn on / off the appliances. Recently, we are apt to use wireless data network terminals such as a cellular phone, PDA or web pad to operate home automation.

### 1) Integrated control

It is possible to monitor the current status of household electronics such as digital TV, DVD, washing machine, refrigerator, audio, and computers. It is also possible to manipulate and turn them off. For example, in case we forget to turn off the washing machine and go out, we can control the utilities and monitor the security of the house even at the office. All of these can improve the quality of living.

## 2) Share of the resources

We can enjoy digital convenience acquired through wide-band communication. They can be applied to A/V electronics at home. Digital contents can be shared among digital electronics such as a CD player and MP3 player. Thus, information can be much more cost-effective.

## 3) Acquirement of information

We can obtain necessary information with a digital TV, electronic oven, and personal terminal all around the house. For example, it is possible to recognize the current status of food stored in a refrigerator and decide when to remove it. The information about the materials can be merged together to suggest appropriate method of cooking, and finally, the user can cook easily. As a result, we can make necessary and effective changes in the management of our daily lives.

## 3. Main issues of home automation

### 1) Outside the home

- a. Whether HN is connected to BBM outside? How about the speed?
- b. Coaxial or UTP cable ? Each should have specific requirements. American cable Home <sup>TM</sup> is an example.
- c. Which service is possible and which will be possible in the future? At present, we connect to the internet, but it will be possible to use telephones, music, radio, and television in the future. These types of media are becoming more digital. Music can be transformed to MP3s, and can be downloaded at home. The appearance of IP phones is very close. Digital TV will be used within two or three years. Now, these services are provided in Scandinavia and Italy.
- d. Is it necessary to support a third party?

We consider whether the appliances at home support an open service. It can be found in the following site.

- e. Who decides which network?

User, telecommunications company, and service provider have different standards.

## 2) Inside the home

## a. Who is the main user?

If it is an expert, it is not appropriate to design as plug and play. AT & T broadband labs and Intel have performed the study about the dependence of the products and services upon the race and the group.

## b. Which services are used?

The service can be provided in two different ways; 1) specialized service among data, voice, audio, and video, or 2) integrated multiple service. Single unified technology can provide all of them, but most of the homes have their own micro-network specialized in their usages which can be linked to some centralized back-bone network.

## c. Which instrument is connected?

They may change in the near future. Home gateway and HMS has appeared.

## d. What is the protocol?

UPnP is a protocol which connects different users and instruments to personal computers.

## e. What is the fate of the old network?

The bridges for UPnP and X-10 are appearing in the market.

## f. What is the range of the necessary band?

SD ranges from four to six Mb/s, while HD uses 19.4 Mb/s.

## g. What is the requisite of QoS?

Data require BE, while A/V media need QoS about priority and jitter.

## h. How about electromagnetic interference with current equipments?

They include microwave oven, portables, and Wi-Fi.

## i. What is the measure in case of electricity failure?

We should consider the battery back-up necessary for lifeline services.



3) How about the life?

Short-term or long-term solution should be devised in terms of cost.

4) Installation and support

a. Is it easy to install and maintain?

b. Who will be the administrator?

5) Development of appropriate contents

Contents should be developed and supplied continuously.

4. Components of home automation education system

1) home network

a. Personal computer is an important platform in telecommunications at home.

b. Internet is important in high speed telecommunication.

c. In future, it is expected that each house has multiple connection to telecommunication ports: multiple telephones; subsidiary phone for internet and fax; Cable TV, and high-speed data..

d. Intelligent electronics to facilitate communication.

2) The point to improve home network for high-speed telecommunications

a. Telecommunication devices and electronics should be connected to a home network and be controlled.

b. Current home network is based on coaxial cable and copper wire. It may be an obstacle to high-speed telecommunication.

3) The results of self test

The results of self test consist of three components: a) Total analysis and the strategy of study, b) Diagnosis depending upon the accomplishment, c) Confirmation of the goal. They are explained in more detail as follows.

a. Total analysis and the strategy.

Total analysis and the strategy are composed of the evaluation range chart, evaluation sheet, total analysis and study strategy.



Figure 8. Total analysis of self test and the medication of study strategy

b. Meditation according to the accomplishment level

In diagnosis meditation according to accomplishment level, the self test consists of the information about the merit and weakness. System diagnosis is a result of the analysis through rule space theory module(RSM). The information about the merit means a satisfactory study in the field, while the information about the weakness means some study which requires complementary study or correction study.



Figure 9. Diagnosis and meditation according to the accomplishment level, which comes from the self test and diagnosis.

c. Confirmation of the accomplishment level in my study goal

In the confirmation of my study goal, the self-test results are compared with the original goal, group average, and target grade average. The results are provided and the relative achievement of the initial plan is shown.

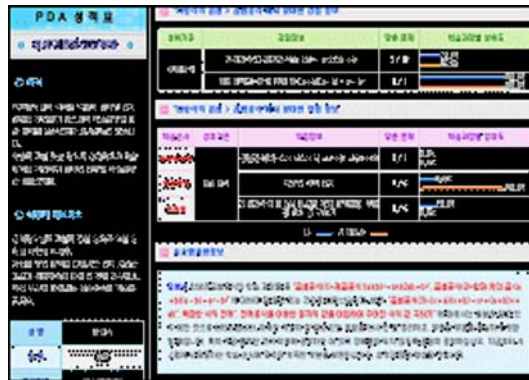


Figure 10. The achievement of the study goal, which comprise the self test results.

4) Clinic (correction study fitted for each student)

In clinic, the study contents are shown in order of the meditation according to the weakness information, which is provided in the self diagnosis test results. Each step is designated with stars. The number of stars is no more than five, and more stars mean that it is better to study the earlier step. The clinic has five different items.

a. concentrated memorization clinic

In the concentrated memorization clinic, fitted study contents are provided in three different types; a) fitted animation, b) voice concentrated memorization, and c) concentrated memorization. The next figure is about concentrated memorization.

b. False concept clinic

In false concept clinic, a student figures out the false problems and similar cases to prepare for the next test.

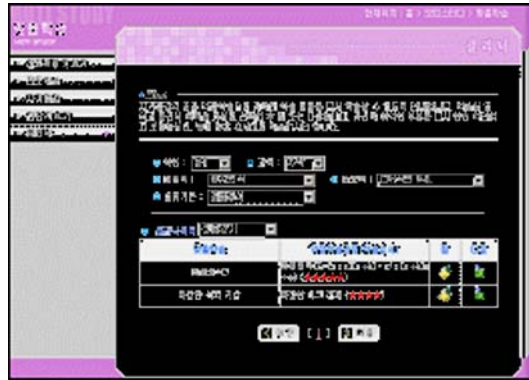


Figure 11. The guide to concentrated memorization for fitted correction study.

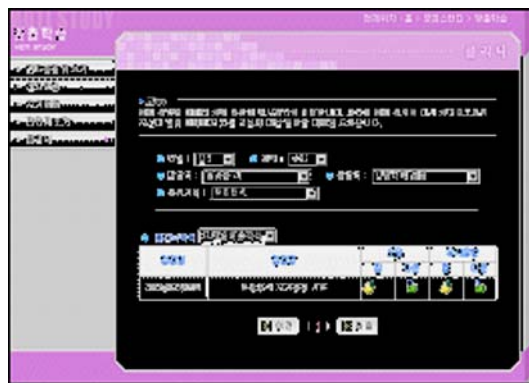


Figure 12. The guide to false concept study for fitted correction study

### c. Preliminary study clinic

In preliminary study, a student can solve an easy problem which is similar to the question at which he was wrong even though it was too easy for his ability.

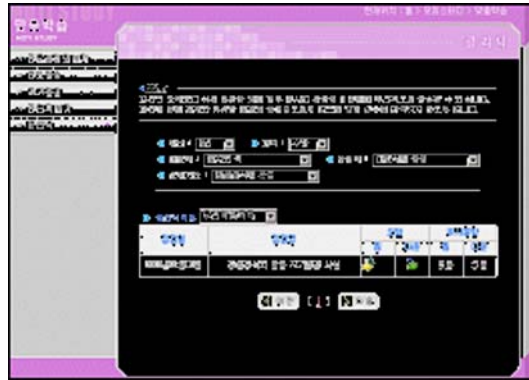


Figure 13. The guide to preliminary study for fitted correction study

### III. Conclusion

The spreading of telecommunication technology has attracted much attention to home automation-based networking, leading to improved education system combined with home automation. This can be further utilized to expand public education with home automation hardware.

In the future, human-friendly home network systems will support environmental technology. This developing technology will support various services including e-learning systems. With all of these systems, a student can get a chance to find a job and acquire updated knowledge. The network system should consider the intelligence levels of individual students and supply educational contents which will develop their potential.

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