Creating Comfortable, Amazing, Exciting and Diverse Lives with CYFARS (CYber FARmerS) and Agricultural Virtual Corporation

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ABSTRACT

Certification and delivery services with the Internet are growing as new businesses in agriculture. However much more new products are required for development of Internet economy, since origin of profits in almost all business models comes down to real commodities thorough advertisement charge. Soon or later the Internet will be available anytime and anywhere, even in fields with wireless communication and wearable devices. This next stage will create enormous businesses in agricultural districts, and it will change life-styles dramatically. Natural environments such as beautiful landscapes and clear streams, which can enrich lives, will be next value-added agricultural products. In this paper, a strategy is proposed to utilize these impacts for creating comfortable, amazing, exciting and diverse lives not only for farmers but also for city dwellers. As a key element, a concept of advanced frames, 'CYFARS' (CYber FARmerS), is proposed to design new agricultural systems and novel life-styles.

KEYWORDS: wireless communication, new industry, life-style, CYFARS, cyber farmers

INTRODUCTION

Farming had been a hard and dirty job in Japan. So far, a few fresh persons (only 223 in 1999) chouse farming professions, and population of farmers has been decreased gradually (10 % of total population, 1999).

However, recently retired urban workers and younger generations who don't have the former impression sometime choose farming as their own life-styles, hobby or new businesses. Moreover, the Internet is reconstructing our society including agriculture and individual lives. So some engineers and SOHO (Small Office/Home Office) has moved to agricultural districts to enjoy faming life and/or natural environments.

Simultaneously growing Internet economy requires more varieties of products for seeds of new Internet businesses, since almost all origins for profits of Internet businesses comes down to real commodities

thorough advertisement charge. For example, healthy/delicious/fresh foods, which are certificated and quickly delivered by information systems, are seeds of new agricultural businesses. And life-styles in natural environments such as beautiful landscapes and clear streams potentially are next new value-added products for residents. Historically industries that consume abundant resources in those days could develop, and consumptions of rare resources ware always a symbol of the rich. Currently abundant resources are transistors in silicon chips, bits in memories, information contents and broadband channels (Ikeda, 1999). And rare resources are natural environments. Farming with advanced IT (Information Technologies) can satisfy both conditions.

Actually we are developing MATE (Multi-purpose Artificial Terrestrial Ecosystem) for CELSS and indoor greenery, which creates ultimate comfortable environments using symbiotic relationship between human and plants (Hirafuji *et al*., 2000b). Our experiences in the experiments and a recent report based on psychological analysis for green amenity (Nakamoto *et al*., 1999) suggest that the most remarkable factors are unaware functions in agriculture such as functions of the comfortableness and the amenity.

Japan's government constructed JGN (Japan Gigabit network) over Japan. MAFF (Ministry of Agriculture, Forestry and Fisheries) are also constructing agricultural information infrastructures such as CATV networks in rural zones with metal or optical cables for farmers (Fig. 1), which partially can serve broadband normal connection to the Internet. Private companies began ADSL services and wireless Internet connection services. For example, an ADSL service is available in Ina-shi (typical agricultural city), and a wireless Internet service by wireless LAN is available in Azumi-mura (village), a typical mountainous region in Japan (Fig. 2). These cases help us to reconsider next phases to create our own ideal lives, which can be also seeds for new IT businesses. Rather, business models that can make profits by creation of ideal lives can perform such projects.

A METHOD TO CAREATE THE IDEAL LIVES

Under digital revolution, forthcoming lives can be dramatically changed by a few efforts. This effect is known as "butterfly effect" in chaos theories.

Our tastes are diverse and the ideal conditions are also different for each person. That is, the ideal lives mean that any peoples can choose one's favorite life-style naturally. So an objective for the ideal lives is to create as many options of life-styles as possible and to keep diversity. Human society and personalities are typical huge complex systems. How can we control such huge systems to perform such enormous missions?

By our theoretical analysis and simulations to universal huge complex systems (Hirafuji, 1999), huge complex systems can make many clusters naturally by self-organization under following conditions.

(1) Number of members in systems is enormous.

(2) Members are fully interconnected.

(3) Diversity of members is large.

SNR (signal/noise ratio; here interaction by communication) among many members can be enhanced, because added noises are offset by effect of central limit theorem. Therefore (1) and (2) are required. And to create different clusters effectively, (3) is indispensable. Moreover in nonlinear systems, very weak signals under noise level can be are enhanced by noises; this strange effect is known as stochastic resonance (Moss *et al*., 1995; Collins, *et al*., 1995). Nonlinear systems such as ecosystems and Internet societies satisfy (1), (2) and (3), and there may be stochastic resonance.

Conditions, (1), (2) and (3), are interpreted as conditions for emergence of new business. For example, let's assume that a young nard boy thought an excellent idea for a business model, but he hesitated to start his project for several reasons such as a lack of experience and capital. If he can broadcast his idea all over the world, certainly some persons whose abilities complement his idea agree with his idea. If there is a system in order to organize *companies in the Internet* (virtual corporations), they can start their project naturally.

Here, "noise" corresponds to peoples who disagree with the idea. Moderate criticisms sometime can encourage their activity, and different opinions are useful for them to find weak points of their project and to forecast troubles in advance. SR may cause this common effect.

INFRASTRUCTURE FOR AGRICULTURAL ZONES

For above scenario, broadband Internet connection service with fixed rate and lower price is indispensable. Unfortunately in Japan, only dial-up connection is available in most areas. Bandwidth is below 64 Kbps, and rate is expensive. Moreover in agricultural zones, "last one mile" (sometime "last ten miles") is another problem.

Wireless LAN systems are one of the best solutions for agricultural zones. Transceivers in wireless LAN systems (access point modules and PC-cards) can communicate within 1.5 km, since there are not reinforced concrete buildings in such areas. Packets can be relayed through access points by a function of IP-tunneling. Agricultural facilities such as micro weather stations and environmental controllers for greenhouses can constitute relay stations. There, residents can use the Internet everywhere (Fig. 4).

Recently wireless LAN devices are becoming appliances for home-use, and prices are going down quickly. Already the price of a set (one access point and two PC-cards) is several hundred dollars, so this scenario is very realistic.

CYFARS: CYber FARmerS

In telephone-based societies sense of peace can be held under possibility of communication, and in Internet-based societies keeping in touch with information can hold sense of peace (Yasuda, 2000). Already cellular phones that have functions of Internet browser are very popular in Japan (48,500,000 users in 1999). However, the bandwidth is very narrow (64 Kbps at most) and the displays are too small. Sooner or later, they will innovate wearable PCs with wireless communication. Wearable PCs with

wireless LAN will be more useful in farming areas, if there are enough information infrastructures.

The most important factor to stimulate information innovation is activity of advanced users who have enough skill of IT and a mind to enjoy their own lives with IT and natural environments. Such advanced users can play a role of a nucleus for virtual corporations. So we proposed an abbreviation, CYFARS (CYber FARmerS) to represent new concept of such peoples (http://yummy.narc.affrc.go.jp/cyfars/).

At least new types of farmers, engineers, researchers and artists who can work anywhere by using broadband Internet are candidates of CYFARS. The Internet, wireless communication and wearable devices will inevitably change agricultural systems and life-styles. That is, concepts of CYFARS are examples for next life-styles or jobs.

CYFARS can play important roles to improve self-organization of agricultural virtual corporations as core members, who can propose new novel ideas and business models. Or they may take places as project leaders, supporters or consultants.

So enormous combinatorial projects can be performed with CYFARS according to various needs of diverse peoples, and every person's life-styles can be also enriched by co-evolution with CYFARS.

SOFTWRAE FOR CYFARS

We have developed a modelbase, which is a database of models, programs and web services (Tanaka *et al*., 2000; Hirafuji *et al*., 2000a). Modelbase systems will be really useful for CYFARS, when they can use both wireless Internet service and a wearable PC in fields. Modelbase can support CYFARS and their new IT businesses in ubiquitous computing environment. For example, they can solve problems immediately anywhere, when they find a problem. And they can develop a lot of software easily on modelbase systems.

CYFARS can enjoy online voice/video chat services while working only by using video chat software such as "MS NetMeeting". It means that CYFARS can work as part-time specialists of gardening and greenery with staying in their districts.

CYFAS working in fields can automatically upload images that they are looking like live web cameras only by wearing a micro CCD/CMOS camera. We have developed an automatic image processing system, which can be applied to automatic data entry for plant growth models (Otobe *et al*., 1998; Hirafuji *et al*., 1998).

CYFARS will be able to develop their original plant growth models as professional modelers only by gathering raw data. We are developing utility programs to extract environmental numerical raw data such as temperature, relative humidity, light intensity and biomass of plants only from image data. So CYFARS will have a function of mobile measurement stations too.

DISCUSSIONS

The innovation of information technology began about 30 years ago. Industries also are reconstructing

their forms corresponding to this evolution. Maybe this innovation will go on another 30 years. So agriculture cannot keep its traditional form against this change.

However, control to evolution of real complex systems is very difficult, because particular impacts cause unpredictable results respectively. Here only macroscopic variables such as diversity of systems, number of elements, states of interconnections and nucleus for clusters (*i.e.* CYFARS) are employed to avoid this difficulty. And universal nature of such complex systems is discussed from Meta level. Additionally following factors can be employed.

(1) Psychological effect

It is a pity that impression to farmers as a job in Japan has never been good. And government policy to protect agriculture had made worse impression, since this policy meant a metaphor that agriculture is a dying industry and faming is a backward technology. However, recently this bad impression is being recovered. A concept of CYFARS may give a good impression with images of "Hi-Tech" and "cutting edge".

(2) Impacts from new IT businesses

To protect agriculture in Japan, only farmers can own farms, and successors of faming can be only their children actually. However almost all children didn't succeed farming for reasons mentioned above. Although there are still barriers to enter into farming for other peoples, these barriers can be interpreted as seeds for new agricultural IT businesses, which may break through barriers naturally.

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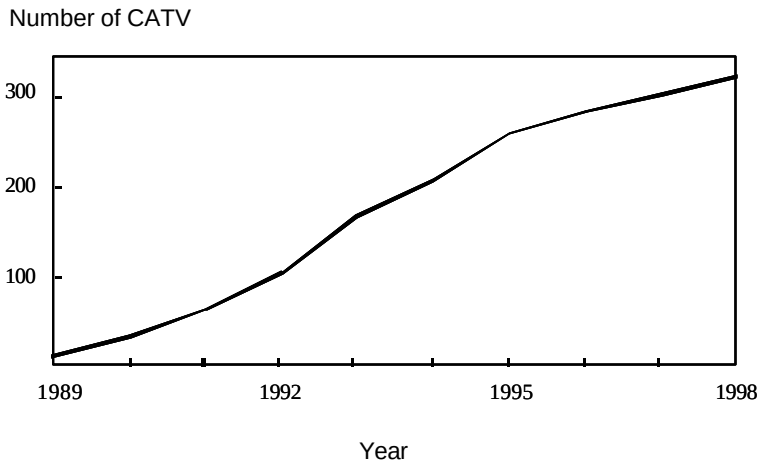
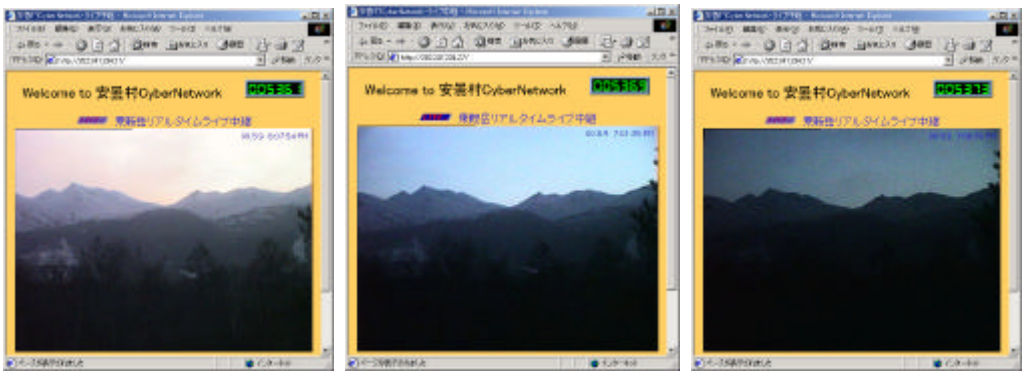
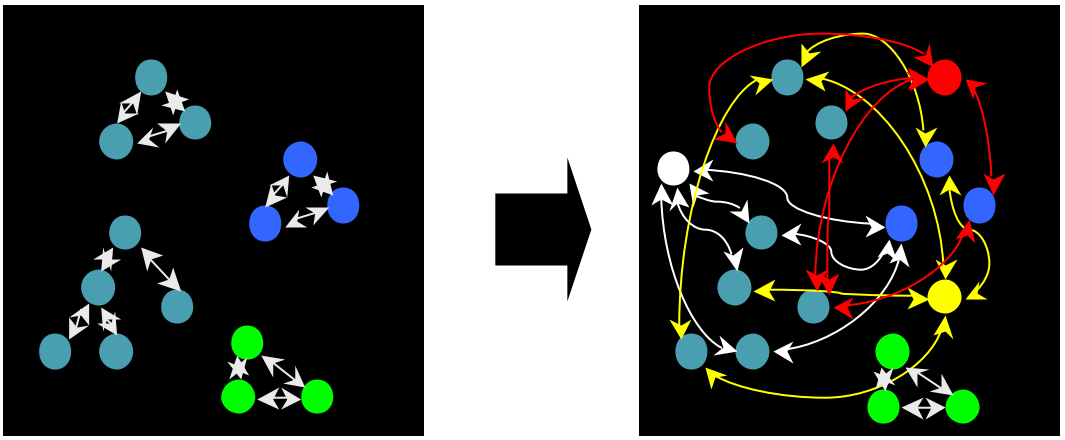


Fig. 1 Number of agricultural CATV services (CATV facilities)



18:07 19:01 19:06

Fig.2 A live camera in Azumi-mura exhibits the landscapes (http://www.azumi.ne.jp/). Residents and loggers of hotels in the area can use broadband Internet service freely anywhere with seeing fascinating real views. Owners and workers of SOHO can enjoy their own lives, if an environment in the area fits to his personalities.



Conventional societies　　The Internet society

Fig.3 The Internet society has enormous members and there are interconnections among members. If members can show different properties, enormous clusters can be generated naturally by self-organization.

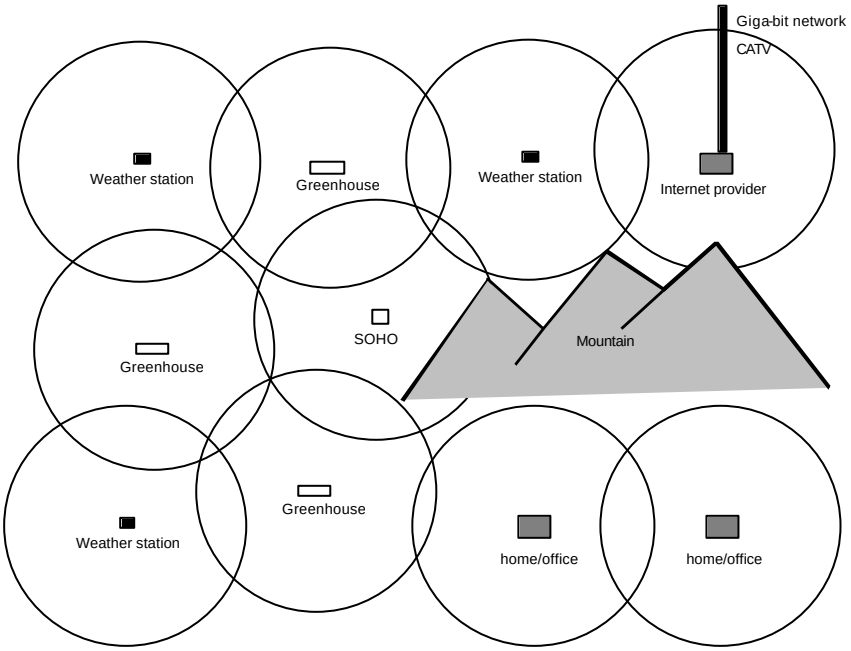


Fig.4 Agricultural facilities and buildings can be relay stations for wireless LAN. Residents in the area can enjoy broadband Internet connections anywhere at low fixed rates.