

The role of simple and common technology in welfare by using the Internet

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Abstract— We discuss simple and common technology as a possible role of engineers in dealing with the various problems of the elderly and also the weak amid the changing society due to lengthening life-spans and declining birthrates. We first describe the conditions surrounding such people that they must face up to and interact with in their life-span. From several major social perspectives, what sort of welfare we wish to realize for the need of closely cooperative relationships with our belonging community. Under the evaluation of historical contribution of welfare technology taking into account of their limits and vulnerability, our approach is hereby discussed from a different policy with mainly securing the cultural backgrounds of individual persons in need, in which relating systems with multiple functions based on high-tech do not necessarily for their widespread use. Thus, we mention the importance of wide-area networks, featuring public benefits, easy replacement of old ones and convenience, in which our technology is marked by safety, reliability and flexibility. The Internet can be effectively used on policies of management including configuration for the cooperation because of its overall convenience with favorable economics and easy-to-handle equipment. We thereby present opinions from technical viewpoints that have been derived from our struggle with comprehensive engineering issues related to developing and practical utilization of basic functions for the beneficiaries. Although our argument and views cover some, not all, pertinent aspects, we will try to illustrate and advocate the roles and possibilities that we, the engineers, can play from the viewpoint of desirable progress in technology for welfare. Finally, we will mention the build-up of appropriate conceptual means for future welfare based on our simple and common technology.

Keywords— Communication systems, Role of engineers, Simple and common technology, The Internet, Welfare systems

I. INTRODUCTION

LONGER life-spans and declining birthrates transformed Japan into an ageing society, with a ratio of the elderly to total population reaching 14% in 1994. As well known, the pace of this change has been accelerating. An inevitable result is the aged society, in which interpersonal relationships have lost structural and economic equilibrium balances to a large degree.

We find such typical phenomena as the elderly taking care of the other elderly in a declining labor population. Thus, comprehensive policies are being urgently needed in order to correct severe imbalances. Any efforts to forge such policies are

required for not regarding present Japan negatively as lacking in vitality and promise. Instead, we should view the nation positively, while listing problems and speaking out, proposing and carrying out countermeasure.

Needless to say, history proves that concepts peculiar to an era, often overemphasis of some features in a social system, and trends in any given times have generated a sizable minority of people in weak positions. However, our argument here centers on the aged society that has been realized in Japan because of the unprecedented speed in human history, with which life-span extension and low birthrates have occurred. Such a society should be dealt with quite differently from past ones as one can see fundamental differences in social backgrounds between the present and the past. Therefore, our argument needs, from time to time, to take into account historical changes up to today in demographic segmentation, popular consciousness and levels of science and technology. These may be necessary in a symbiotic society containing mutual relationships and joint activities among the same generation or between different generations.

However, to our regret, no one in academia or elsewhere has so far come up with clear answers to questions about how a society should be. Thus we are groping in the dark in an attempt to build up a “culture”, in the broad sense of the word, while considering new human relationships in a different kind of society. These efforts of ours will require a large amount of time.

We will here describe how our thoughts on welfare underwent a change in the process of development of engineering measures and its real-life applications [1]-[3]. We also discuss the importance of what we call “simple and common technology”, and its further development and results of concrete applications, together with the proposed path, through which we can contribute to solving welfare issues in an aged society. The proposed path will be paved with problems regarding government policy and technical systems management that we have encountered.

II. CONTEMPLATING WELFARE IN TODAY’S SOCIETY

A. Basic welfare to be considered

Whenever talking about welfare in today’s society, it is inevitable for anyone involved to mention people in weak positions, whose existence stems from social distortions, which in turn are caused by longer life-spans and falling birthrates[3]. That should serve as the first step towards the discussion of

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welfare aimed at revising the concept of “culture” in the broad sense of its word, in the light of new human relationships in a new social structure.

In its Article 25, the Constitution of Japan states, “All people shall have the right to maintain the minimum standards of wholesome and cultured living”.

Despite the explicitly stated guarantee, we must acknowledge the existence of refer to “the socially weak” or “the weak in daily livelihood” —people who are stuck in hard-to-overcome surroundings e.g. in cramped living place and insufficient time, because of internal or external social conditions, or because of individual persons’ situations as illustrated by different broken lines in Fig.1. Thus, they are obliged sometimes and always to depend on someone during their life. Therefore, one may assume that welfare should aim at “forming a state for co-existence” between people trapped in society’s distortions and stuck in weak positions, and those close to them “with a guarantee that they can mutually influence among them to an appropriate degree” as illustrated in Figs. 2 and 3. Granted that this is acceptable, we refer to surrounding people such as families who share foundations for living, people in neighborhoods and friends, inclusive of residents in near districts. What we have in mind is that the weak accept support from said “surrounding people” in an attempt to overcome

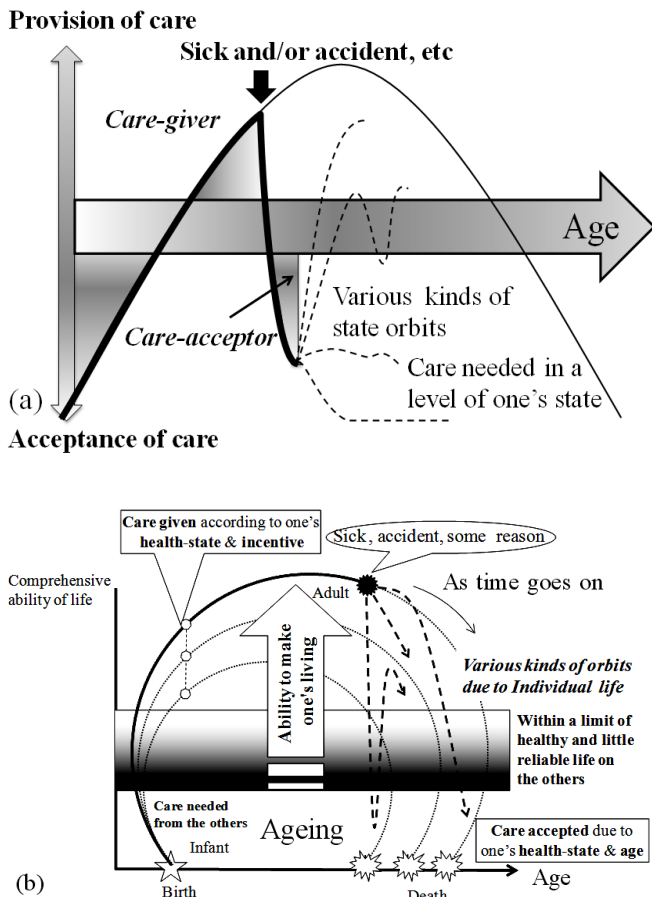


Fig.1 (a) Typical individual life state which may derive in various ways according to the internal and external conditions encountered. (b) Range of active period on time going according to a various personal characteristics with different environment, generally seen in

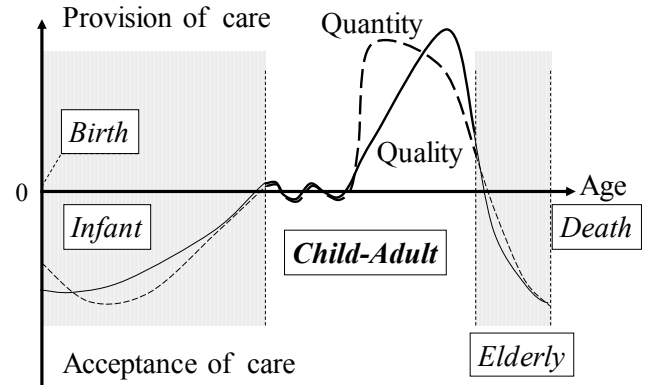
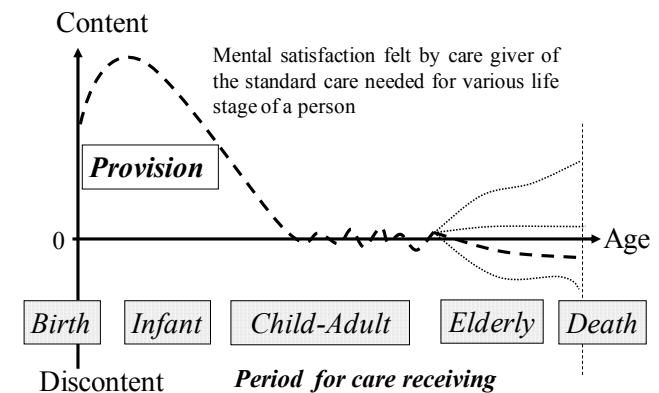
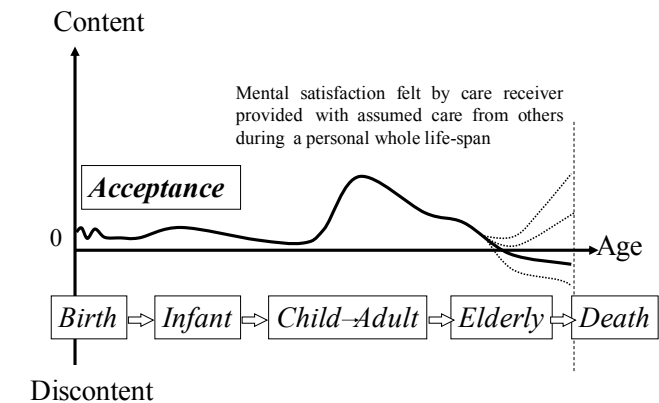


Fig.2 Assumed quantity and quality of care and assistance, as obligation and volunteer, accepted by a beneficiary from the others according to his/her individual life stage, living ability and their mutual relation.



(a) Typical mental content of a care giver providing with assumed standard care to other persons.



(b) Typical mental content of a care receiver provided with assumed standard care from other persons

Fig.3 Typical mental content/discontent of a care giver and care receiver according to their individual life stage, living ability and mutual relation.

various difficulties while being guaranteed privacy protection.

That is to say, one has to seek a balance between rather contradictory concepts and actions — between “interferences from the outside, based on a society’s duties” and “a

beneficiary's independence as an individual, based on his/her rights". Welfare's essential meaning is in creating an environment allowing him/her for interactions based on such a balance.

To paraphrase: "the weak are the people who are not guaranteed, for either internal or external reasons, the environment in which they can insist on their rights to live".

Thus, they include those who happen to have unfavorable social relationships or stay in economically recessive environment, and those who suffer from inherent physical or mental disorders or from acquired and time-dependent decline of physical and/or intellectual ability according to ways shown by the different orbits in Fig.1. But this description obviously does not present an accurate picture of all the "weak". Actually many so-called the weak suffer from either physical or mental problems, with their conspicuous disorders preventing them from carrying out average social activities.

It follows that lack of freedom, as may be caused by the unfavorable physical environment, makes them suffer like anything while trying to perform work. We are hereby afraid that "the weak" tends to cause some misunderstanding. Because it does not refer to an individual's comprehensive ability, hence a failure to grasp these people clearly. As a result, concerned people tend to overly emphasize the immediate need to get rid of "a situation in which disorders keep affecting because of inadequate offering of assistance and caring that should guarantee their rights to live".

Such an emphasis or overemphasis is likely to lead to a shallow judgment or an illogical jump to presenting economic aid to help alleviate physical problems. Many are likely to believe that the weak may stay weak permanently, overlooking the fact that the aid provider and the beneficiary could not reverse their positions or situations.

On its part, the Japanese Society for the Study of Human Welfare and Culture maintains a thesis calling for "support to realize independent living by providing constant experiences rather than training or guidance, while filling absence and supporting in the case of inability". Our group thus cites its concrete goal, while the last half of the excerpt is an essence of welfare, "practice generates substance".

Thus, the practice of welfare activities, that is, the support for realizing independent living, makes clear both the guarantee of humane lives and the roles which concerning people play. They realize the rights and duties between them in great detail. Consequently, all this points to the importance of bringing about an environment in which the both parties can simultaneously feel a sense of fulfillment in the process of supporting rather than a physical, mental and economic burden. Important are the voluntary, considerate mutual approaches, the resulting sense of peace of mind, gratitude and satisfaction on both sides in a situation marked by remaining strength for carrying on work concerning an averaged life-span of beneficiary as suggested by Figs.2 and 3.

Needless to say, the welfare defined here is not the benefits offered to the weak by a social system. Instead, it is "a culture of

new human relationships", which should be created for all generations, including the healthy, and which can be sensed routinely on the basis of roots in a nation's cultural climate. Without such a form of welfare, healthy people, who serve as the prime movers, can neither support a society vital enough to keep the weak people's livelihood nor move in the appropriate direction.

That is, welfare requires "a culture in which the both sides can co-exist and cooperate", accompanying kinds of obligation and/or satisfaction with possibly coming back gratitude with satisfaction; something everyone is likely to experience of both situations according to their comprehensive abilities during life-span.

B. How to aim at welfare considering history

Historically, though the specific forms varied, both societies based on fisheries & hunting and agricultural ones were marked by collaborative relations and simultaneous joint works, respectively. Heavy and light labors were shared among the members of these types of societies, with welfare characterized as "one kind of activity assigned as part of natural living".

Setting aside fine nuances, one can equate it with "a culture called human relationships". In both sorts of societies, people played appropriate roles, depending on their age, physical and intellectual power. At this time in history, mutual aid continued without interruption throughout one's life, with the cycle to be repeated to form a longstanding historical flow. If this flow is viewed as a spontaneous prototype model of welfare, one may naturally be tempted to re-create a system of the same sort in today's society. However, changes in both economic foundations and human relations, due to the changes in whole social structure, naturally make it impossible to consider such a form of welfare as the one to be left to the next generation.

Incidentally, social chaos as caused by spread of infectious diseases and other disasters is coped with by aid and a community-wide assistance from the humane standpoint, as is well known and easily understood. But all this is fundamentally different from welfare. Epidemics and the like lead to various forms of emergency aid that last a relatively short period of time. Such efforts, while representing noble humane activities, come to end sooner or later. One should notice that these efforts usually are "acts of goodwill with the ending foreseen", which promises psychological ease, or promised liberation in terms of time.

A similar psychological or emotional factor is present in child-rearing, too. Children require enormous amounts of labor and trouble until they grow up, but parents can usually anticipate that their offspring will come of age and that it should free them from the current work. They usually can see light ahead. They can even have great expectations for the future. By comparison, an elderly dementia patient seems to require endless care — a natural psychological factor — even though, actually, such a care has its end. That stems from the fact that a voluntary caregiver may begin helping a person with a severe illness with humane goodwill but long hours of work make one feel that he/she has been deprived of time.

Ironically medical care's development has resulted in the need to protect and take care of increasing numbers of people, regardless of age. To date, a society's foundation has hardly undergone a major change because of altering population factors. Despite fluctuations of individuals' presence, the whole population has generally enjoyed virtual stability. Accordingly, support, determined by balanced demographic distribution, has traditionally provided natural stability with relative ease. In other words, population composition has been regulated by natural rules governing and limiting people's existence, and autonomously placed on a "stable orbit" within a natural framework. Thus, there may be some problems that could be corrected by the attempts to restore population composition and a structural foundation. That cannot be done easily, however, largely because of a few factors — rising education levels, shifts in living conditions, such as clothing, eating and housing, as well as repair of unhealthy conditions by medical care that works as a controller of individuals or a whole society. As a result, family composition and family system have witnessed major changes to such a degree that it is difficult to judge what type of family and which regional environment fits the current society, and which help us maintain the society's dynamism. Needless to say, it is necessary to verify whether or not a situation similar to the current one has existed in history, and if so, whether or not efforts have been made, aiming at the improvements and maintenance of repaired functions.

Furthermore, it is necessary to carry out comprehensive study centering on the impossibility of welfare, caused directly by shifting population composition. The study can be so designed as to find out whether or not a sustainable "stable orbit" ever came into being after welfare was affected, and how auxiliary systems, if any, worked.

III. IMPROVING THE ENVIRONMENT FOR WELFARE

A. Before contemplating our roles

A social security system — the backbone of welfare — has historically been nurtured in Japan and has matured and expanded. But its various elements that were originally well-intended now show signs of declining because, as time went by, society changed, and the system's tasks and operational problems mingled with each other in a perplexing way.

However, one should not merely devote oneself to finding faults and defects. Instead, one should regard the defects as inevitable in a transitional process leading to a better situation and try to come up with solutions. The fact is that human wisdom always fails to find instant solutions to the unknown.

Here we would like to present our stand on technological possibilities to supplement our whole discussion. Generally, support relating to daily life is extended to people whose functions declined because of ageing and also to young people and those in their prime who have functional disorders and need time to make attempts at self-recovery, and so on. Thus, in Japan, where aged people's share of life has been on the rise, these elderly souls seek and enjoy frequent interaction with the

healthy part of the community. What has been basically sought after and what has been a major task have been the development of function-supporting systems of equipment and communications. It is also noteworthy that dynamic auxiliary mechanisms have become major pillars of welfare to assist people to adapt to the environment and to help restore functions — the subject of much discussion by many people from the standpoint of technical progress. True, the applications of such devices have been explored with good intentions, and by people concerned sincerely with taking into account the beneficiaries' surroundings.

All this has been considered as welfare. Still, such consideration and actions are often inadequate. That is to say, something is absent: consideration of the healthy people. In this sense, the current state of affairs is somewhat lopsided. For a society to maintain its vitality, a social environment is indispensable in which the healthy can work without any worries.

Building up of this sort of an environment is indispensable. However, not enough attention is being paid to this point. Without such a consideration, the whole system is prejudiced, making it impossible to establish the true state of mutual aid, which we regard as important. In addition to this point, we would like to equally emphasize the importance of creating a symbiotic environment based on improved communication systems. That is because the establishment of "a culture called new human relationships" requires communication as its foundation.

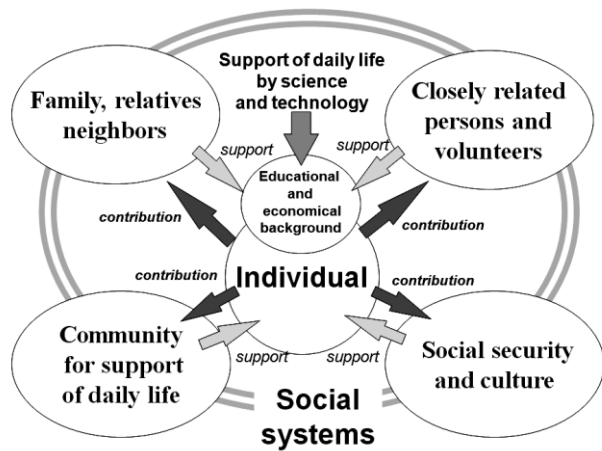
To maintain its vitality, a society has to improve itself so that everyone can make use of his/her potential, whether he/she is weak or not.

Our role calls for technology development based on these opinions and needs, incorporating the viewpoints outlined above. Before we proceed to the central theme, though, we should mention the present environment surrounding welfare.

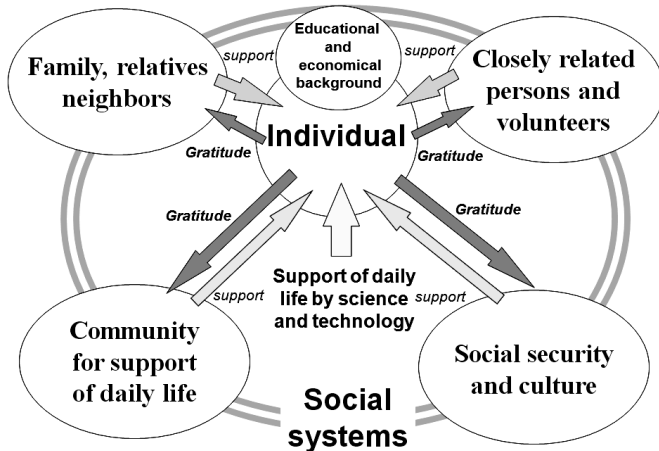
B. Government administration

Japan has operated and maintained medical care insurance, nursing care insurance and a pension system — all characterized as the state's economic guarantee for the beneficiaries — while occasionally verifying and reflecting the systems. Still, the management of these schemes generates inconvenience. To be more specific, beneficiaries detect everlasting problems because administrative officials often indulge in ambiguous ideals and lack efficacy in dealing with managerial issues. The beneficiaries often wish to keep their independent lifestyle in peace of mind as sole purpose by the pertinent systems. However, even in such a case, they occasionally need some special supports, which will be actually provided from essential point of view in welfare.

All this may be a burden on people as seen in various situations, especially when it comes to budget appropriations, and when it exerts a significant influence on society as illustrated by Fig.4 in the cases of beneficiaries in two typical situations of persons with different background. As one way around such problems with different background, various



(a) A beneficiary with no special problem of health and finance



(b) A beneficiary with the problem of health or finance

Fig.4 Social and private assisting system affected by the different state of an individual person.

forecasting and preventive means should be practiced. This means setting different roles to different welfare experts and dividing up the support for beneficiaries. Such methods are commonplace in the world of technology. However, when applied to welfare, this has caused not a few problems. In theory, economic benefits should be realized by separating at different levels the rules of care giving people and beneficiaries, but, in reality, assigning roles is not so easy and can have disadvantages for beneficiaries.

Discussion on welfare has so far inevitably touched on three golden words. They are: “impartiality”, “fairness” and “openness”. These are the qualities demanded of administrative bodies. But it has turned out to be extremely difficult to set up a system meeting the three criteria and to put it in practical use.

The ideals are only fine, and then it would be rather recommended to realize the large framework of easy communication in order to ensure free contact among the closely related people so that it may be basic means of relieving them from uneasiness in daily lives.

Thus, what matters is restoring a number of dispersed small societies with sufficiently enough institutional infrastructures for free communications — integrating those by information

communication techniques (ICT) in a low-cost. Then, people can have peace of mind thanks to reduced mental and physical anxieties in their daily lives[4]-[7].

As we have presented the view that welfare is a culture of human relationships, it is also important that the whole society develops and improves a widespread cultural environment to which scholarship, arts and industry can contribute. That is an important grope for realizing fruitful welfare as a whole. As a result, the improvement of the environment to such a level has lately been noticed, together with increasing interchange of ideas between similarly minded people. In various places, people are groping for ways to improve the culture of welfare and for specific measures to reach this goal.

C. Welfare by medical care

Medical experts, acknowledged to be playing important roles in society, together with their beneficiaries, should be constantly thinking about their roles and limits, or the light and shade of their profession, that is, the merits and demerits of the whole society as well as the individuals.

That is because the longer life-span or artificial extending of people’s lives, both made possible by medical progress, is open to the question whether or not this automatically leads to their happiness from the perspective of human dignity.

Putting aside the light, one can say safely that a consensus exists about the shade that whether or not securing a long lifetime is a sufficient condition promising good purpose of life or realizing a true self. There is a full agreement that this is a controversial issue.

We would like to emphasize another point that, since the roles played by the people working on the borderline between medical and social aid strongly reflect the changes in social structure and functions, they can also play an important role in adjusting functions of a social system. Such an adjustment was often realized as a result of the medical experts’ collaboration with professionals in other fields in hitherto unknown ways.

Medical care activity today often means monotonous and hard work on duty and/or obligation that lasts too long for humans to handle. To carry out such jobs smoothly without complaint requires some cooperation of people from other fields. In not a few cases, collaboration to introduce

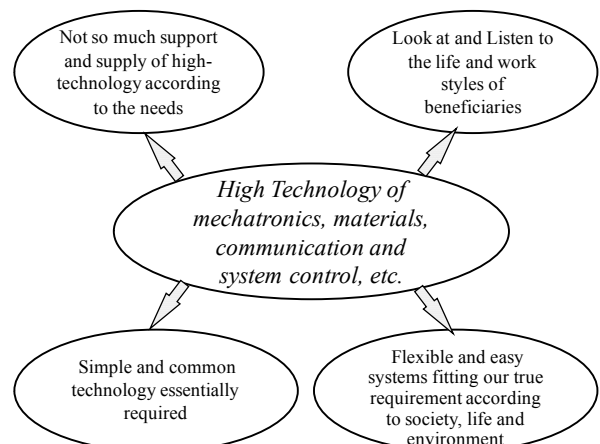


Fig.5 Concept of filling absence of beneficiaries by the inexpensive and robust technique

engineering methods will be a solution to a given problem, in particular some dangerous work in the concerning area.

Similarly, we need science and technology that can support welfare activity. Smooth use of interdisciplinary knowledge requires mutual understanding with people in other areas, which can contribute to access not merely concepts but also practical use. Engineering, which has so far tended to be seen as inorganic in nature, can prove its true meanings or show its power to medical care.

It is conceivable that, while preparing for the next stage of action, engineering can be aggressively made use of as the prime mover to realize reforms that can be expected to make true progress, following the study of past achievements and effectiveness in comparison with the conventional ways in the past.

How so? By assuming that medical care and welfare are changing systems that respond to social shifts, system engineering can serve as an effective means of finding a standardized method to analyze and evaluate the whole system, which has not been subject to enough logical scrutiny.

Though what we advocate may sound like an abrupt change of strategy, logical dealings with anticipated developments in various related fields, such as the concept of welfare, should desirably involve standardized rearrangement of concepts and system descriptions according to purposes, which ought to lead to realistic, standardized conclusions for both social systems-related and technical subjects.

Concretely, this refers to accurate descriptions, based on medical care and welfare information, of noteworthy internal situations and changes in mechanisms. Conceptually, with logical backgrounds of systemization, this aims at helping medical and welfare staff to manage and maintain, efficiently without any waste, a whole system, including operators' roles, maintenance control, evaluation of gaps between goals and actual state with peripheral factors.

Furthermore, as for people's actions, such as hospital or medical treatment and nursing care, they could come up with possibilities of applications clearly and logically, through building up their own intellectual systems needed in daily work

or through structural reform.

If this is done, with the cooperation from people in science and engineering fields, they can be expected to deepen their understanding of the technology involved and even help find specific clues to further technological developments.

D. Family, neighbor and community

Since a person's relationship with his/her family members defines the essential affiliation for living, its importance is obvious. In other words, the roles to be played by a family in welfare carry extremely important meanings. What's more, emotional aspects rather than logical ones are the most important. That is because exposing emotion, based on a family's shared sense of values, is the centerpiece of such a relationship. In not a few cases, expressing emotion serves as a starting point for generating wisdom as well as principles of action. Nothing surpasses emotion as a factor in welfare activities as a whole, when a person obtains spiritual satisfaction from voluntary work, while ignoring profitability and other elements, and whether or not he/she holds an official nursing education. While special education and training are important, as provided by programs in connection with government-issued licenses, equally important are the interactions in a given community that have nothing to do with interests and economics. Here the community refers to the one in which people can mingle without any special means of transportation, the kind of community that has been declining because of changed social structure. We refer to the village, or village-like areas that existed in Japan until around the time of the high-growth period of the Japanese economy in 1960's. What mattered then was solidarity. People maintained close relationships. Accordingly, the restoration of so-called villages, or the good old days becomes a topic from the perspective of culture as human relationships. However, nostalgia for such an age alone cannot help find solutions to today's situations.

An emergency medical system has been realized by the present author, based on a similar concrete concept, while "village", as mentioned earlier, is still an important concept of mutual assistance organization even today. Amid the trend towards lower density of communications in our human relationships, building-up once again of a village-like community, marked by "high-tech", aimed at to realize easy and simple function by "low-tech" is now technically feasible — a realistic task that can be examined. That is, what is called "community care" — a system featuring the possibility of a needy person opting for a specific type of service on his own, whenever and wherever — can be built in reality, even though some systems will have limits, depending on the telecommunications network.

E. Engineering technology

An old question arises: "Can engineering technologies replace a human being?" The answer is "No"; basically, although the progress of various sorts of technology has made it possible to meet requirements requested by many people. However, when it comes to re-creating the delicate intricacy of

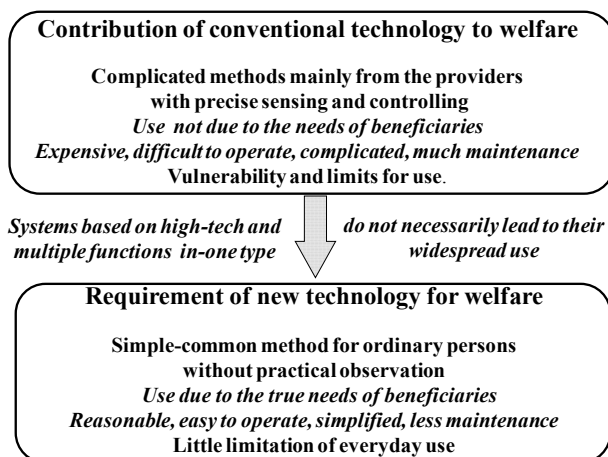


Fig.6 Our insisting welfare technology for the beneficiaries

human beings, the engineers' efforts have to center on measurements to grasp situations surrounding a subject, and on the need to develop finely graded responses to control various kinds of equipment. All this requires highly advanced technology, which in turn means a considerable amount of engineering work and a large investment in many forms. One can anticipate a counter-argument that, at the initial stage, only a few may benefit from new technology because of the high costs, but lower prices, following mass-production, should make it available to masses of people. This conventional wisdom alone cannot help solve welfare's economic and ethical problems, because safety is important, and maintenance is costly.

Suppose a system is operated as a closed, complete one, generally speaking, its technology alone with virtually no exceptions cannot grasp a human's actions, including predicting his/her actions. Highly advanced technology is required particularly for accurate measurements of a person's every move. An even more knotty problem is the possible violation of privacy of a person whose activities could be recorded and measured. Extreme caution is required of judging privacy issues. A demand-oriented approach, or accepting this and that request, could promote privacy-invasion. As a solution to this problem, a flexible self-control of privacy is conceivable: judgment of privacy by the application of artificial intelligence (AI), into which a third party cannot interfere. Even in this case, however, ultimately an outsider is involved in software control. For this reason, whether or not the AI-based approach can cope with the problems existing between interference and cooperation is very much open to question.

IV. WHERE IS WELFARE ENGINEERING'S POSITION?

A. Possibilities of interactions with society

Based on the introductory remarks, we are now ready to proceed to a core discussion of how we can advance the present system technology in connection with society, while keeping in mind what we should and could perform.

The presupposition is that it is important to build *small, simple, common and flexible systems* for individuals involved in welfare rather than introducing a large-scale/complicated

system technology. Such systems as we advocate promise economic advantages from the standpoints of *feasibility, safety in operations, reliability and dispersed malfunctions*. This is because technology not only has limited usefulness but also can possess unpredictable, fundamental defects, regardless of its scientific level.

A large-scale, advanced and complex system cannot necessarily claim advantages because a defect brings about serious adverse impact on the neighborhood. A technology requires adequate period of time for testing in various conditions to alleviate defects before it can be used directly and routinely. Without such consideration, a large and complex technology in particular cannot be guaranteed in daily smooth operation.

Another important viewpoint is to make it clear that simple and common technology is to support what a person needs essentially. Such a technology is intended to assist both the so-called weak and the healthy people. This means joint utilization and complementary activity.

Simple and common technology also means that people can try to resolve individual problems, while its intellectual and technical achievements should be able to give favorable effects to a wide variety of fields.

Since it can serve as food to nourish a new culture, such technology is indispensable in Japan, where its declining population can hopefully be countered by strengthening its intellectual and technological prowess. It can lead to the vision of the next wave of technology and welfare.

B. What roles can engineers play?

Engineering is about realizing something new, varying from micro to macro systems, by improving and reforming existing things with the human hand or skill, based on scientific endorsement and from a scientific standpoint, and about the technology that enables such a process. Accordingly, the engineer is thought to be capable of developing competent welfare technology, big or small, which suits laborious nursing care under varied circumstances. It is also true that actual application has natural limits.

The elaboration with a desire to build a system which boasts high functions comparable to those of human beings and which can accurately cope with every kind of situation, leads to exponential increases in costs. Even if such a system is realized, its continuous operation is difficult to maintain, in its widespread use. This is not to deny the merits of such a technology; the useful development of systems with devices, and resulting solutions of problems mark the anticipating important birth of new technology from the standpoint of engineering. From a social viewpoint, such a technology also can have lots of possibilities of commercial applications.

In this context, let us think what roles the technology we develop should play in society. We reiterate the point that it is economical to build up a flexible changeable arrangement based on small and common systems that fit our real needs, so to speak "our body size and height" and that such a scheme can help the weak and healthy simultaneously in daily routine.

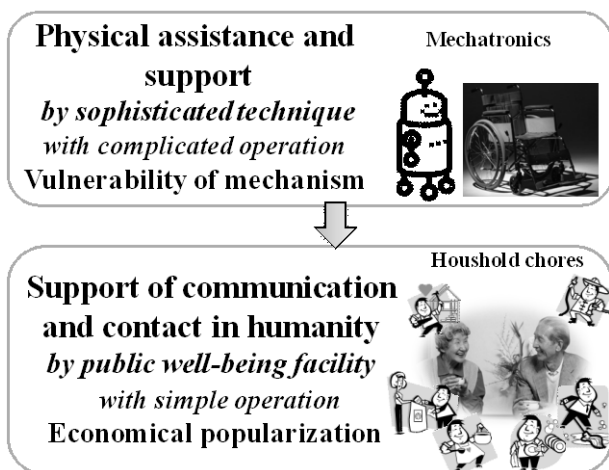


Fig.7 Priority and focus change from sophisticated system to communication system

Evidently improving existing or future welfare tools alone cannot pave the way to a better welfare environment. It should be emphasized once again that for the simple and common systems to function properly, the technology for integrating them needs positive cooperation with administrative bodies.

Whereas the welfare tool development should take into account the use by the healthy that share lives with the challenged people, the welfare environment has to meet demand for technical quality from the beneficiaries and for low costs and fees from the beneficiaries as consumers.

The cost factor has essential effects on utilization and diffusion. Thus, the introduction of new facilities is important as the utilization of the low-cost Internet, which supports services in a wide area. Various methods have been developed so as to realize all this.

The wisdom to be born of the knowledge accumulated hereby serves as a core for making best use of new technology, and should be utilized as a major pillar supporting the central structure of human relationships. From this viewpoint, it is observed that, if scientific achievements and their evaluation by society generate mutual effects, desirable synergistic effects can realize towards building up of a society with new human relationships.

In a historical perspective, seeking larger scale and complication have been major themes accompanied by the progress of various systems since the Industrial Revolution. In this process a technology or a product good for all or multiple purposes has been acclaimed — a tradition that remains today. That is not always desirable from the viewpoints of welfare.

Nowadays, as much of the machinery based on advanced electronic devices tends to be compact and requires reduced energy consumption, the extent and size to which they exert effects have become large, with their operations so complicated that the procedures surpass human memory capacity.

If this trend remains unchanged, the functions which engineering has realized cannot give full play on the part of the public, and cannot maintain contacts with people. Thus, engineering achievement may fail to return favors to society.

Meanwhile, there is a welcome phenomenon: public opinion has gradually shifted in favor of technology's meaningful

contribution to the welfare of humankind. Technology, as observed from this perspective, has been providing social vitality through its popularization. The long-distance welfare service, which we have been researching, is an extension of such a trend, and maintains closer relations with society than other systems.

C. What sort of welfare engineering we should aim at?

Historically, technology's progress and spread, in not a few cases, failed to lead to popularization, thus closing the path toward good returning to society. Healthcare, for example, is among the typical terrains where the beneficiaries do not feel its benefits enough and widely in society. At least in Japan's hospitals, which serve as the core of healthcare, many patients are often forced to wait for their turns for a long time. What follows is likely to be a meeting between a faceless patient and a faceless doctor, in which (questionable) benefits are offered.

Reasons for this situation abound, but it essentially shows the fact that medicine has been carried out without adequate consideration of the general public's interests. The original purpose of medicine calls for "a clinic to practice medical science", while today's hospitals are something else, leaning towards being "institutions to treat diseases". This gap is detected by masses of people, who sense a rift.

As regarding long-distance medicine, on which we will concentrate later, the public can understand its general purpose, but its practice makes people feel as if they were out of place, thus giving an impression that it is not operated with beneficiaries in mind. Even if medical welfare can be actually made available from a distant point, the systems tend to be convenient to experts, while the beneficiaries are expected to indirectly have them. However, probably thanks to the changing trend of our times, the people concerned have somewhat changed their ideas about long-distance healthcare services. As a result, unlike at the outset, there are signs that they try to offer safety by making up deficiency and filling up what is lacking, while making the appeals to various layers of society. On site, meanwhile, the convenience of information equipment is being increasingly discussed.

Given this situation, it is important for those in the public sector to administer server software management so that the beneficiaries can have access to a system via standard equipment, such as personal computers available on the shop shelf. Realizing such an arrangement seems the right thing to do.

Thus, experts are requested to develop effective terminal machines: inexpensive ones, which amateurs can use in a wide area and for a long duration. Indispensable are the machine's guaranteed safety and easy maintenance.

That is to say, the desirable welfare-system operation can be summarized in simple phrase: from the standpoint of beneficiaries, it should be "inexpensively used in a simple way". Excessive features are unnecessary. When one gives consideration to the practical concept of minimizing initial investment without reliance on economies of scale, something will emerge naturally: effectiveness of building-up a welfare-system management, based on the Internet functions

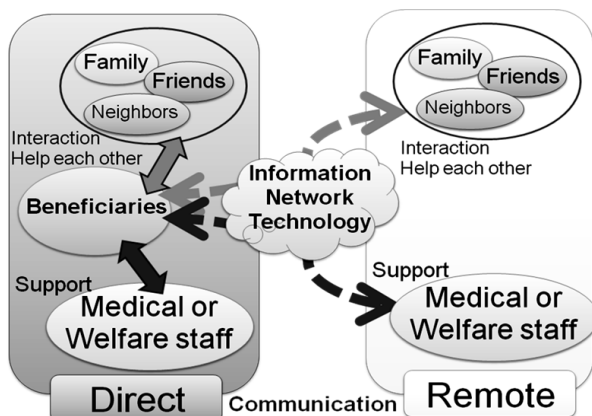


Fig.8 Concept of distant welfare by the Internet, taking account into the role of communication in Welfare

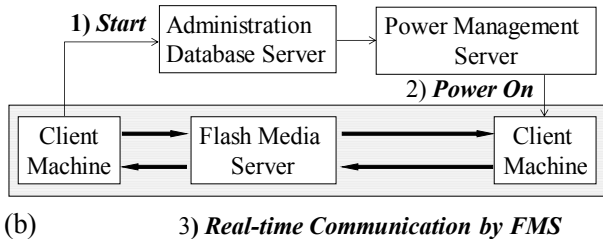
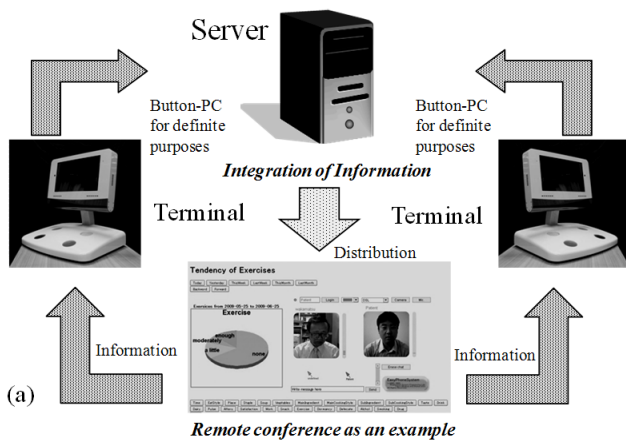


Fig.9 (a) Real time communication system based on FMS and button type computers handling necessary information. (b) Diagram of combined system inclusive of automatic start-up of computer in destination[8].

suitable to these needs. That is, it covers simple and common technology with reasonable price, easy operation, no special software, maintenance and ubiquitous utility for every concerning purpose, and thus it leads us to our developed actual telecommunications system.

Such a scheme makes best use of telecommunications that can be used individually and in a wide area. Easy operation that enables anyone to handle a machine's general-purpose functions, and reduced costs fill the conditions for a welfare system and its widespread utilization, as we envisage it.

V. TECHNOLOGIES FOR WELFARE

A. Basic system technology for distance support

Considering that life-care needs various levels of support, we have so far tried to come up with system developments and operations that suit specific purposes. Concrete supports in individual case were connected with academic fields of science and engineering, and the comprehensive arrangements of individual elements and coordination involving information communication techniques (ICT).

The technology we have realized is the kind that can lead to the development of a comprehensive communications system, whose scope of applications and possibilities can expand naturally as it interacts with people. Thus, we have applied our technology to welfare purposes, which in turn grew further and combined with ICT, resulting in remote-management

Table-1 Comprehensive welfare stages related to various concerning experts

Status	Person in charge	Place	Method	Daily life
Healthy	Family	Home	Tele-Health	Benefit by Remote System
Help, Assist & Care	Home Helper	Home	Tele-Assistance	Work, Chores & Shopping for Daily Necessities
	Care Worker		Tele-Nursing	Playing
Nursing Care Medical Care	Emergency Medical Technician	Facilities	Tele-Medicine	Rehabilitation
Emergency		Physician	Ambulance	Medicine
	Nurse		Hospital	
Hospitalization				

technology[8]-[10].

After undergoing experimental operations, many branches of our technology are about to be put into practical use as remote-welfare, although their possible applications to welfare deserve a discussion.

Our system is technically based on the principle that the contents of communication from each node are consolidated in a server before its re-distribution [1]-[3]. All that a beneficiary needs are simply just a web-camera and a computer equipped with a microphone. The required server is as commonplace as the one we have in our laboratory. Upon receiving a message, the server in a network automatically offers execution files to a user, thus he/she can get going promptly to use the system. The scheme works as an on-the-web multi-functional dialogue system in which multiple individuals related to various concerning experts as given by Table-1[3],[10]. It represents various kinds of participation in the comprehensive welfare for requiring stages. That is, various sorts of welfare have overlapping participation of different persons in charge as given by the second column corresponding to the help of daily activities for the beneficiaries.

The beneficiaries are timely provided with various systems such as entertainment, assisting & rehabilitation and common experience programs as sharing of space and time for people living in remote spots[8]-[10].

B. Welfare systems we have realized as examples

1) Entertainment system

First, we mention a system-based game "playing" by aged and challenged people located in remote spots by a network. Those who wish to do so can join in the games or recreation on the screen directly and without preliminary learning. They can freely quit at will, too. The image change and sound level are sources of driving engine, which allows him/her to move objects on the screen. The player recognizes himself/herself on the screen, and sees his/her own movements and moving objects. Nothing needs to be held by hand. An integrated communication enables plural people located separately to join in a game. One can enjoy a game involving the whole body's movement with an enhanced sense of presence or a group game. A bed-ridden person can see the images on the screen held on a ceiling to join in a game, or may opt for using the system for communicating

with people outside. Psychological and physiological effects can be expected from the player's reaction to his/her own movements or from the stimuli from outside with face-to-face communication.

2) *Assisting rehabilitation programs*

Our attempt here centers on a remotely-located rehabilitation expert offering guidance to people in sparsely populated areas by use of the Internet. An instructor first grasps a subject's condition from conversation and images on the screen or through a care-person before offering appropriate instructions to him/her. Muscular tension and feel, for instance, cannot be directly learned, but a family member can do the job. Assisting rehabilitation is at least partly or mostly possible, with action and posture confirmed through adequate communication in the presence of a care-person. The aforementioned games may be incorporated into a rehabilitation program so that a recreational approach can be adopted. Receiving professional guidance is thus possible even in areas without resident experts, with both parties saving expenses and time. As a matter of fact, physical therapists confirmed the effectiveness of such an approach.

3) *Sharing living space in remote areas*

In today's society, family members living separately are a common phenomenon. Keeping in mind that a family sharing place and time is usual in ordinary living, we have carried out projects to develop a system to realize just that. A person living alone and in need of nursing care in particular wants such a system in earnest. But we also took into account the possibilities of covering a healthy worker located away from his family. The system for this purpose is based on the one we developed earlier, into which mobile and compact web-camera with wide scope variable-angle was incorporated. This arrangement can be expanded to include binocular web-camera, which will be instrumental in realizing a virtual family journey for a bed-ridden patient or a member forced to stay at home. However, given the mobile equipment's present communications speed, such a trip cannot be planned everywhere, but the future will see us overcoming current hurdles.

4) *Home as design office, and medical aid*

Our achievement also includes the development of a simple and easy-to-use management system intended to help patients with lifestyle-related diseases. This one was later applied, giving birth to an advisory system so that a medical expert can reach out to a patient to realize proper administering of pharmaceuticals and dieting. In addition, we came up with a new approach to record supply of food and other data. As for "eating habit situation, cooking methods and food intake trend" and "deviation from daily routine in living attitude," we are able to figure out approximate differences on a certain day from usual daily life. Another system, based on 3-dimensional stereo-vision virtual reality technique, enables a physically challenged person to carry out design and other production work while staying at home or in bed. This can offer an environment for partly disabled people or sick in bed to "Self-actualization" and to maintain "Aim in life" Furthermore, we have been developing a system that can automatically

provide a person suffering from sudden breathing difficulties with automatic auxiliary breathing. This first-aid is coupled with a function to automatically notify a doctor or a medical institution of illness for remote diagnosis as partially illustrated by Fig.10 [1], [8].

VI. WHO IS TO MAKE PROVISION FOR REMOTE-MANAGED SYSTEMS?

A. *Software management*

We have chosen to place all the basic functions of our systems on the server's side, with the necessary system software running there, too. Accordingly, all that a user needs is merely hardware available on the computer market. So the user can benefit from our systems immediately after purchasing a personal computer.

Our servers, as a rule, not only are individually independent, regardless of size, but also allow the user to make use of other servers in other areas under the appropriate transmit route. These features are fundamentally different from various other systems that have so far been proposed. In other words, our systems can be very suitable for building up a scheme as a public enterprise.

In fact, the aforementioned functions have been proved feasible by test operations based on existing small computers and an experimental infrastructure in our laboratory[8]-[10]. The software needed to fulfill system functions can be jointly used, regardless of distance, by using server-to-server links. But the most significant feature is that a beneficiary basically does not have to buy an extra software program, while if people in charge of a server develop software for running a system, others can have access to it, via the Internet. Ideally software should be developed by a public organization, and a server may be leased, which can be convenient for maintenance purposes. In order to meet residents' demand efficiently, including the one peculiar to a certain community, managers can develop unique software. If one server happens to need repairing, the aforementioned linkage makes it possible to use another for uninterrupted operations — another advantage. In light of these points, in conclusion, the bodies suitable to maintain the network systems are small and medium-sized cities, and towns and villages in provincial regions. Administrative units can join in that are capable of offering software systems to solve peculiar regional problems.

B. *Telecommunications infrastructure*

For our systems' functions to be utilized, information communication environment has to be improved. Realizing systems convenient for the users in particular requires ubiquitous features so that "whoever" can have access "whenever and wherever", while the capability of smooth traffic is necessary for the transmission of text, voice and moving pictures as well as some vital signs, for example.

In such an environment, fast-speed mobile communication is also necessary, with room for improvement remaining. However, some regions still lack fixed-line telecommunications

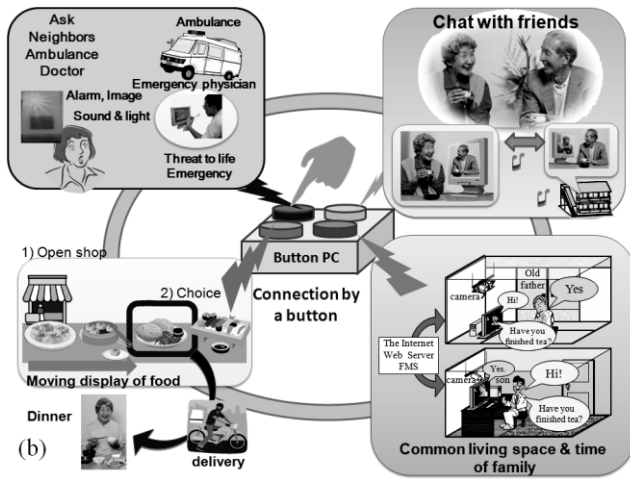
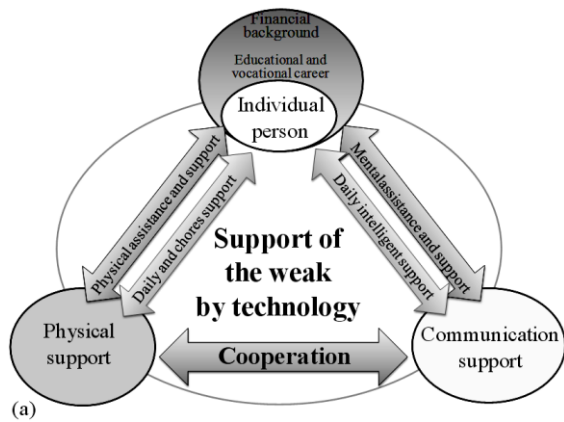


Fig.10 Important systematic support in need for the lonely living by family and closely related persons realized on our basic information technology.

capability with high enough speeds, posing problems as this fact blocks the introduction of long-distance medicine and welfare systems.

In today's Japan, base-to-base communications face few problems, but not a few regions suffer inadequate environment as for a base's connection to points in sparsely populated areas. Widespread availability of broadband communications reaching these outposts is an urgent need to support health care and welfare communications. Also indispensable are nation-wide same-level networks pointing to future infrastructure, and improving basic communications functions for direct "door-to-door" access to computers.

C. Developing handy, easy-to-use terminals

We are ready to touch on the development of terminal equipment that can basically meet the aforementioned needs and promise easy operations, an important factor from the standpoint of individual users. The equipment should be the one that will not recall a computer's complicated procedures. What is important is developing particularly press-the-button communication gadgets with selected purposes, which one can use easily and smoothly even in an emergency situation.

The purposes include the protection of one's own life in emergency, crime prevention, daily chores such as shopping,

and dialogue with particular persons, friends and closely related persons, by the simple operation for the inevitable needs of the living alone regardless of the old or the young. What suits these purposes is a principle which appears like a de-facto exclusive line involving registered addresses, even though it is actually based on the Internet. Developers do not bother to keep the weak in mind. Instead, they are recommended to opt for a convenient wireless terminal machine, which can be used ubiquitously in the future. In actual use, a compact and lightweight gadget will be appreciated. What is more, we advocate that the product be fashionable so that a future user can enjoy carrying and running it. It should be considered as a useful object in everyday life.

Here we are pondering on technological development for welfare that could tread the basic research & development pathway steadily and reasonably. Further efforts should be made not just for realizing standardized technology for network integration but also for cooperation aimed at producing world-widely standardized equipment.

From the user's standpoint, comprehensive technological establishment is needed that takes into account easy operation, a smoothly running screen and audio capacity, as well as portability.

D. Role of "small and common technology" for welfare

The systems we have developed, as mentioned in section V, and then realized real-time multi-lateral communications among parties located in faraway places, with flexible design changes making them fit to various welfare purposes. These systems of ours represent "simple and common technology" which suits both our height, so to speak, and the Internet environment. Their introduction into society and widespread use is economically easy and practical.

In order to realize welfare's large objective—creating a society in which both the weak and the healthy can be independent and pursue the purposes of life—an environment is needed that offers good mutual communication. But the ongoing modernization and urbanization in Japan have caused once ubiquitous regional communities to decline, particularly in the provincial areas hit hard by ageing population and depopulation. In these areas, transportation, let alone industry, has become weak, aggravating the problem, making it difficult to restore the old community.

Therefore, building a new kind of community that can help to create human relationships is a necessary condition for supporting society in Japan, which is likely to be marked by longer life-span and low birth rates. Given this situation, our "simple and common technology" holds latent possibilities of making various contributions.

That is to say, our systems can be expected to help improve the environment so much that those who until recently were incapable of communication with others and mutual assistance because of physical distance, position, age and what-not would now benefit from "I'm beside you" proximity. Such reciprocal aid is not merely psychological in nature. It also covers physical things, such as rehabilitation at a faraway site, production

activities and emergency health-care service plus sharing and consolidation of necessary information.

All this points to the possibility of re-creating a society, in an organic manner through the Internet, where new human relationships are conceivable that can overcome problem caused by place and time. This new process can refer to the past merit. The good traditional elements preserved in the old “village” could be revived without being bound by place and time. Consequently, a foundation could hopefully be laid to forge a society where all people, without distinction between the “weak” and the healthy, could help each other and carry on as independent beings.

The attempts to help revamp communities through our “small and common technology” may be considered a milestone of our engineering work towards creating new human relationships. Our efforts are intended to correct distortions, which are likely to increase in our society, from a perspective of welfare.

VII. DISCUSSION

When examined from the standpoint of improving human relationships, to our regret, science and technology have so far often tended to move negatively backward, contrary to the intention of the people involved. Needless to say, the neutral standpoints of science and technology academically should be respected and observed, but political influences and other factors have often led the people concerned to ignore expecting social benefit by the application of scientific and technological outcome.

Despite this kind of drawback, however, there existed engineers with their own ideas and beliefs who tried to transform their vital energy into concrete results, which formed a vortex. Our research team, for the past 30 years, has tried to conduct research and develop engineering technology that could be useful at the site. Our research & development has kept a social viewpoint of applying our achievement in science and technology to medicine, nursing care and support for the challenged people.

The systems we have developed have efficiently realized real-time multi-lateral communications among parties located in faraway places, with flexible design changes making them fit to various welfare purposes. These systems of ours represent “simple and common technology” which suits “our body height and size”, so to speak, and the Internet environment.

At present we are entering into the stage where our efforts are focused on building and improving a basic welfare system as an evolving extension of our technology. This will hopefully provide an opportunity for debut of a number of better systems based on technology marked by working on the human mind in a flexible and supple fashion as well as at reasonable prices and easy operation — after an organic fusion of an improved infrastructure, telecommunications technology and so on.

However, we should not forget one fundamental point: the technology we aim at must not be one that blocks human activity and its possibilities, because of its unnecessary or excessive supports. After all, science and technology or at least the good

alternative will be traditionally intended to satisfy people’s habitual desire and advantages to seek easy interactions with society.

VIII. CONCLUSIONS

It is quite natural that the new technology should possess two features in our life: incorporating scientific and other achievements that fit the present social structure; while seeking after a culture that is helpful in forming a new kind of human relationship based on own tradition.

Now, we harbor an ardent wish — revealing one of the aspects of this engineer — that future trial-and-error efforts and new knowledge will help to increase the opportunities of “weak” people in joining in social activities and solidarity, which will help to result in a more livable society where people can feel warmth towards each other.

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