2010/4/16

Research Themes of Nakatani Lab.

1. Four Major Fields

(1) Disaster Mitigation

Researches about the information management system, the decision support system, the evacuation guidance system, and so on, in order to reduce the possible damages by the disasters. The current themes include the business continuity management system, the evacuation guidance systems of the sightseeing visitors, the evacuation planning system about the wide-area big events (e.g., Tokyo marathon), and the hearing-impaired people support system.

Core technologies: Artificial Intelligence, Man-Machine Interface technologies

(2) ITS (Intelligent Transportation Systems)

Researches about the driver support systems, the passenger seat support system, the road management system, and so on. The current themes include the sightseeing navigation system that does not provide the detailed route information, the driving training system for the Sunday drivers, the system to support the drivers who have no sense of direction, the snow-removal support system, and the road anti-freezing support system.

Core technologies: Artificial Intelligence, Man-Machine Interface technologies

(3) Fond Memory Engineering

In large-scale disasters, many people lose the reminders of their past lives, such as albums, diaries, videos, and souvenirs. Such reminders are strongly connected with treasured memories, and they often face the difficulty of getting over the psychological shock of the disaster, resulting the difficulty to restart their new lives. This theme aims to support such people recall their memories by providing triggers (e.g., photos, newspapers, maps, popular songs), and uses the memories to communicate with other people who have similar experiences.

Core technologies: Artificial Intelligence, Man-Machine Interface technologies

(4) Kansei (Sensitivity) Engineering

Kansei (Sense) engineering is a method for translating feelings and impressions into product parameters, in order for the products to be designed to bring forward the intended feeling. It can measure the feelings and relate them to certain product properties. The systems includes the music recommendation system, the fashion coordination support system, the communication support system by using the pictograms, the supporting system of individual action and cognition by personal tempo, and so on.

Core technologies: Man-Machine Interface technologies

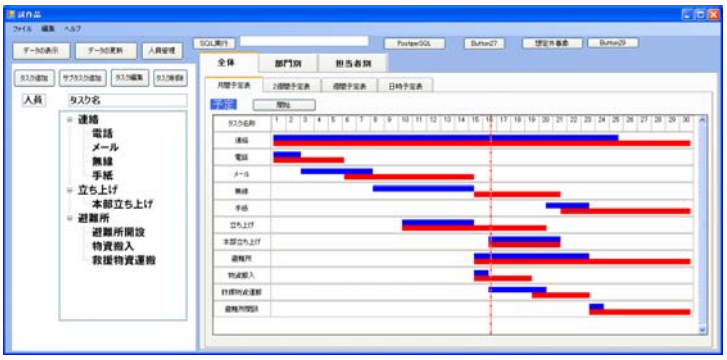
2. Examples

2.1 Disaster Mitigation

(1) Business Continuity Support System

BCM (Business Continuity Management) is a total management to support companies to continue their business even in disasters. There is, however, a few information system to realize BCM. Our approach is to support planning of countermeasures in the form of Gantt chart, considering when a certain task should start, who is to be assigned to the task, and when the task should be finished. This plan can be used as a plan execution management, as well as an electronic manual, when a disaster attacks. Characteristics of the system are as follows:

- The comprehensive event generation function which supports the planning against a wide variety of situations as much as possible.
- The personnel assignment function which proposes who should take charge of a certain task when a sudden task is required in disasters, as well as in the planning step.

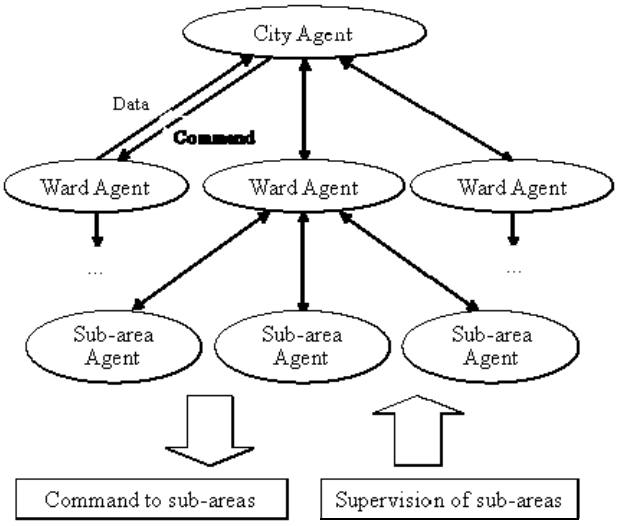


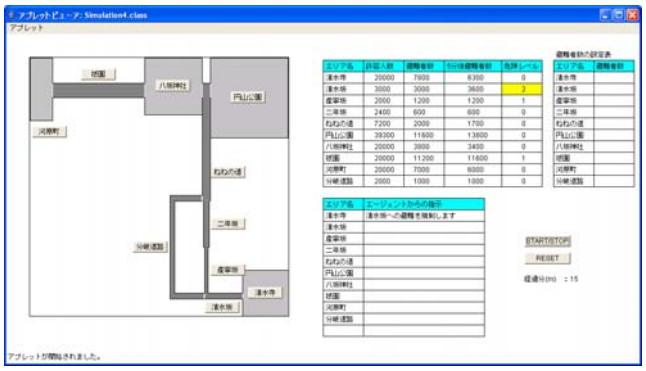
(2) Disaster Education System

To promote disaster mitigation, it is very important for people to prepare for possible disasters so they can help themselves (self rescue). As most people have not experienced catastrophes, they have difficulty imagining the problems that they may face in a disaster. Past disaster cases are used as the source data of realistic knowledge. The problem here is that the “Normalcy Bias” prevents some people from recognizing the relationship between past cases and their daily lives. Our approach is to simulate the risky situations that may occur in individual daily life. When a user selects a specific time and situations from his/her own day schedule, the system presents the possibility of a certain kind of risky situation through showing past cases that actually occurred at the similar time of day and conditions. Thus the users can realize that such a situation may occur in their own life.

(3) Tourist Evacuation Support System

Disaster support systems have not been much investigated for victims in unfamiliar environments such as sightseeing travelers and people on business trips. In this study, potential problems facing tourists in disasters are analyzed and a new method to support them is proposed. First, the decision-making process of the tourists is modeled when they meet disasters. According to the situation, appropriate support methods may differ. Based on this model, a decision support system is proposed using a multi-agent framework. The lower level agents supervise local areas, collect data on site, and send them to the upper level agents. The upper level agents make judgment and send instructions to the lower level agents. We apply this framework to Kyoto City, which is the most famous sightseeing city in Japan. Computer simulations verify effectiveness of this method.



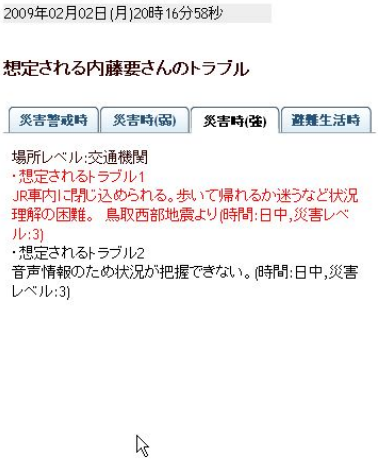


(4) Evacuation Support System in Large-Scale Wide-Area Events

Many people participate in large-scale wide-area events like marathons. For example, the Tokyo marathon started in 2007 and drew 1.8M people, including 35K runners and 10K volunteers. The countermeasures against possible disasters during marathons have not been investigated. In this study, the runner model is constructed to calculate how many runners and their supporters are at a certain point on the route, supposing that the supporters move preceding the runners. Based on the model, the system simulates the possibility of acceptance of the evacuation centers along the route, considering the number of the runners, the supporters, and the residents. We used the Tokyo marathon as an example and successfully evaluated the acceptance of the evacuation centers at five major spots, including the start point, Hibiya, Ginza, Asakusa, and the goal.

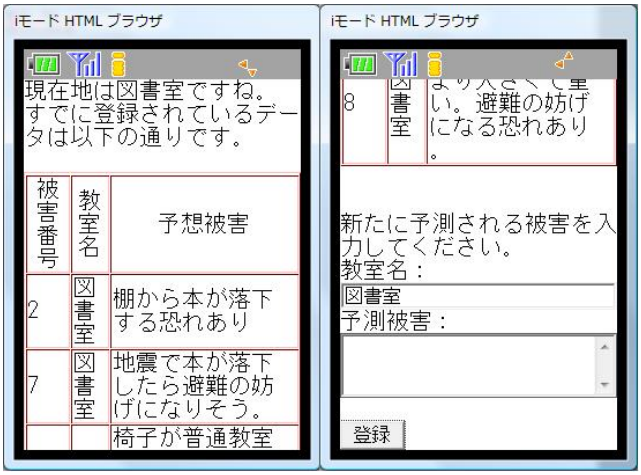
(5) Communication Support System among Hearing-Impaired People and Volunteers

When hearing-impaired people are attacked by a disaster while they are out, they meet with different kinds of troubles from disabled people. They are unwilling to ask their voluntary helpers for help, worrying that the helpers may also be in troubles. To support such hearing-impaired, a system is proposed which infers their possible troubles based on their current location and the knowledge base, and asks the helpers for possible supports in place of the impaired people. The current location is identified by the GPS data. By considering the characteristics of the location (e.g., station, shopping mall, on the street), the system searched the knowledge base for the past trouble cases occurred in the similar location and common-sense knowledge about possible troubles. The system asks the helpers for help by using mobile phone text messaging. Experiments verified the effectiveness of this method.



(6) Disaster Prevention Plan Formulation Support

Disaster prevention plans are important to protect students from disasters, but they are not sometimes based on the actual situation in each school. It is important to consider issues which are discovered by teachers in daily school lives. To formulate appropriate plans, the system is proposed that promotes discovery of issues based on the location of teachers. The teachers read the 2D bar-code set on various places, e.g., entrance of a classroom, by their mobile phones. The system identifies the location of the teachers and asks if there are any issues to consider when a disaster occurs. The teachers take a look around, and they send memorandums to the system when they find issues, e.g., danger of desks by the window. The issues are linked to the related parts of the plan by the system and are discussed to solve afterward in a teacher's meeting.

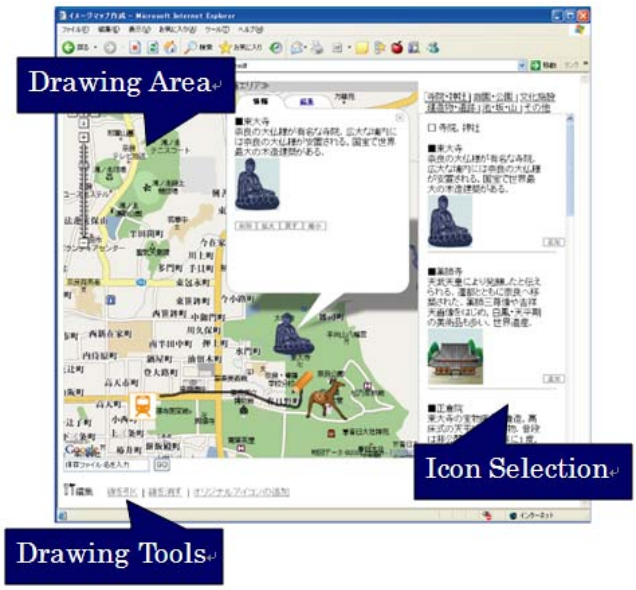


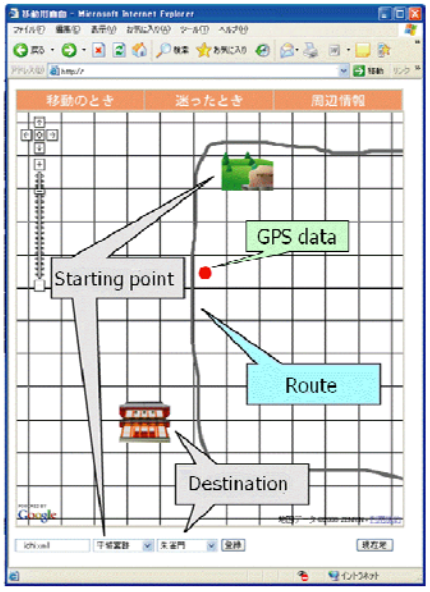
2.2 ITS

(1) Tourist Navigation System

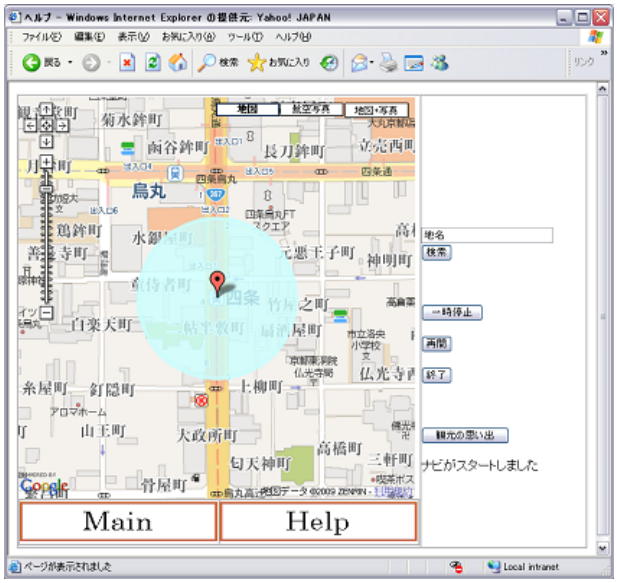
We propose a new approach to the tourist navigation system that does not provide detailed route information. Most of conventional navigation systems provide the optimal and shortest route from the current location to the destination. This often changes sightseeing stroll into an act to trace the recommended route. For tourists who like to stroll in the city, accidental encounter with new routes, people, shops and spots is essential to enjoy the visit. In our approach, users are required to make a sightseeing route plan before the visit, by deciding which spots to visit and how to reach the spots. They use the icons to specify the spots to visit, and draw routes freehand on the digital map system. When they start sightseeing, the digital map is not displayed (hidden) on the mobile computer, and they can only refer to spot icons, freehand routes and the real-time location data from the GPS system. Three of them are all ambiguous information and are expected to promote accidental encounters. Experiments showed that the system promoted the interaction between the users and the

environment, and induced accidental encounters.





Another information hiding method is evaluated. In the new method, 100m in radius around the user is hidden with a white circle. The color, transmission factor and radius of the circle can be changed. This method is found to dazzle tourists by extinguish their sense of location and to promote interaction between the tourists and the environment. Even repetitive visitors feel uncertainty of route.



Basic idea of orienteering is introduced to tourist navigation. To navigate the tourists, photographs of landmarks are used. The system provides the tourists with an aerial photograph of the target area to hide the detailed route information. Along the route, some checkpoints are set. When the tourist select a checkpoint, the system shows the photograph of a landmark along the checkpoint. The tourist can approach to the goal by finding the checkpoints in order. The photographs from opposite directions and the photographs in the past are included, which makes orienteering more difficult and exciting.

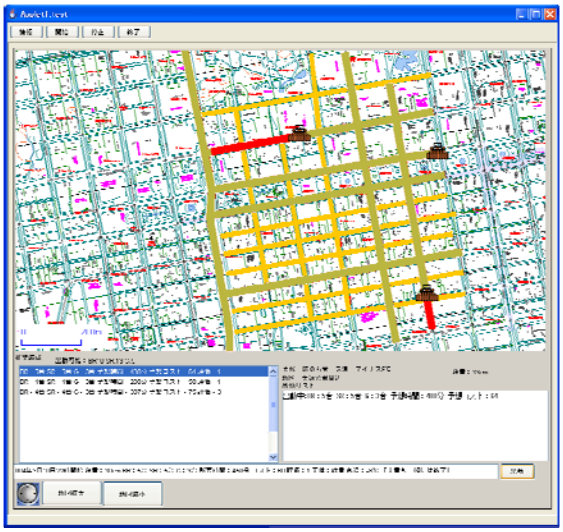
(2) Sunday-Driver Support System

There are many drivers who have driver's licenses but never drive. They are called “Sunday drivers.” When they start driving again, they feel uneasy because it is not easy for them to judge when they should be careful about what targets in driving. Many driving schools open courses for Sunday drivers, and some driving simulators teach them what should be watched in certain timings in driving. But such courses and simulators do not teach proper timing of judgment. We propose a system which teaches the timing and target of judgment, using videos from driver’s seat. In watching the video, the user presses the space key when he/she judges that it is the time when something dangerous may happen. The system provides the alternatives of what may happen, and the user selects one of them or a sequence of them. The system evaluates the result, comparing with the standard answer. Through subject experiments, the effectiveness of this approach was verified.

(3) Snow Clearance Direction Support System

Experts have made direction for snow clearance in snowy regions. Direction tasks are performed by experience-based, and snowplow drivers have relied on their directors. However, many expert directors are to retire at the age limit within a few years. Successors must face difficult circumstances which they have never experienced before by keeping the quality of directions even if they were insufficiently trained. In order to support such unskilled directors, we propose a case-based direction support system which reuses past direction cases. Each case stores data of weather, snow, number of snowplow, time taken to complete a snow clearance task, and evaluation of tasks by a director. When an unskilled director specifies task conditions and the system searches for similar cases to the conditions. When the director selects the most similar case, the system estimates the time required to complete the task based on the snow and road conditions. The director can also

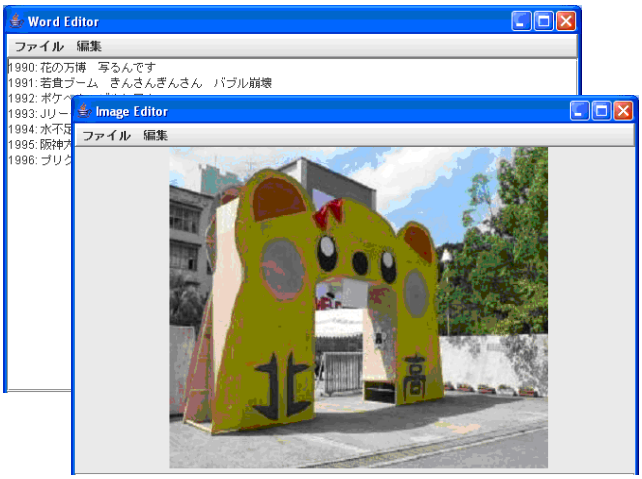
manage the snow clearance task progress on this system.

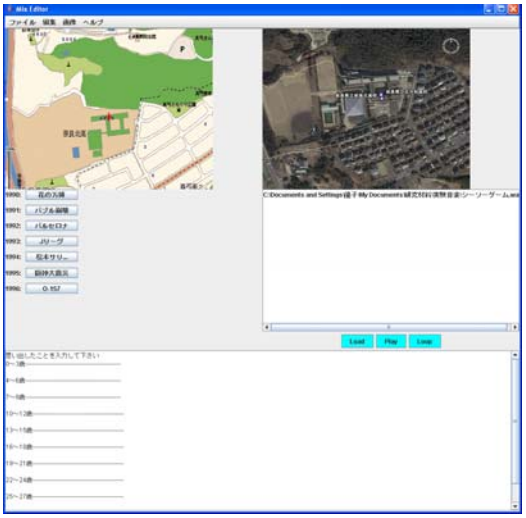


2.3 Fond Memory Engineering

(1) Fond Memory Recall Support System

To support people who have lost their mementos in disasters, the system is proposed that provides reminders, such as photos, songs, maps, and events, to invoke recalls. The recalled memories are stored in the form of text, and are managed in the database. This study compared effectiveness among the reminders through subject experiments. Subjects were asked to write down memories of their elementary school days recalled by various kinds of reminder. The result showed that effective reminders differed in individuals, that recall was difficult when only texts were provided, that aerial photos were effective when used with maps, and that memories of junior high-school days and high-school days were also recalled. Based on this result, we designed a system which effectively invokes recall.



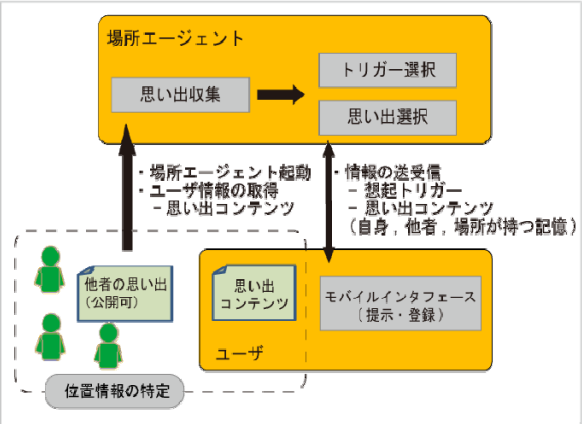


(2) Location-Aware Fond Memory Sharing Support System That Invokes sense of nostalgia

This research thinks the real-world location as nodes which link the present and the past, and one's own self and the other people. Based on these hypotheses, our system supports people to recall their past memories when they visit places of memories again.

The users store their own episodes in the mobile PCs. The local software agent (LSA) in the server on site stores the visiting records of the users. The LSA always tries to communicate with the neighborhood mobile PCs via wireless network. When a mobile PC answers back, the LSA recognizes the visit of the user and searches the

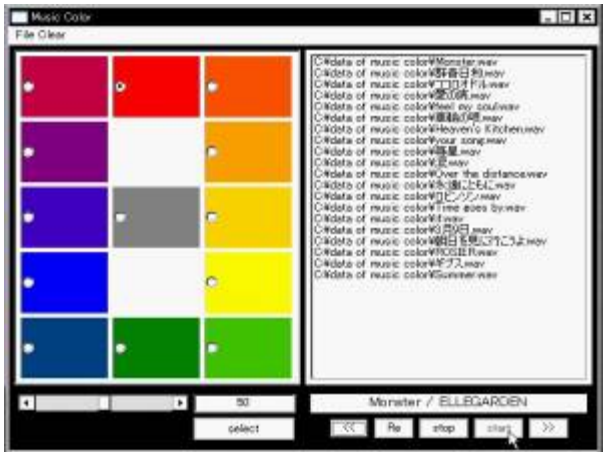
user's mobile PC for the user's episodes open to the public. The LSA presents the user his/her episodes about the location, changes of the location after the last visit of the user, and so on. The LSA morphologically analyzes the user's episodes, finding keywords to select the related episodes. Experiments verified the effectiveness of the system.



2.4 Kansei (Sensitivity) Engineering

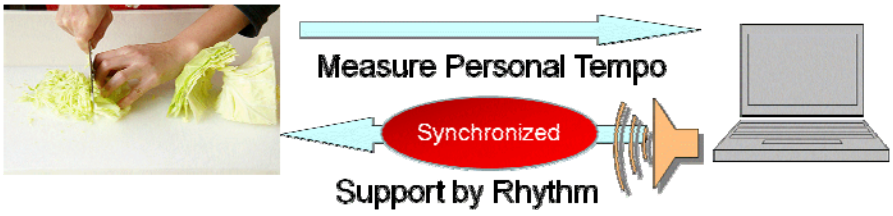
(1) Music Recommendation System

A new method is proposed to recommend songs by considering feelings of a user. Unlike existing methods, our new method represents feelings by using colors, based on a concept of "synesthesia." We conducted subject experiments in order to relate songs to feelings, and colors to feelings, by using the Semantic Differential method. Songs and colors are located in the same three-dimensional space of color-feeling factors. When the user selects a color which best represents his/her current feeling from the color palette on the computer display, the system calculates distances between the selected color and each song. About ten nearest songs are selected and are recommended to the user in the order of nearness. Experiments verified effectiveness of this method.

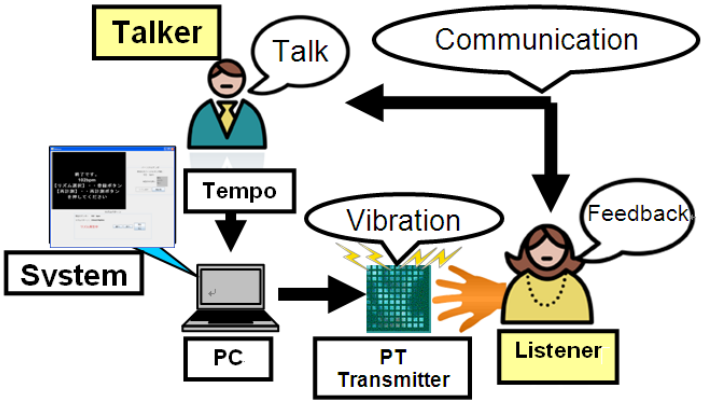


(2) Control of Personal Tempo to Support Individual Cognition and Action

We live in our own rhythms in daily lives. The rhythm is important for us to live in order and cheerfully. Each person has his/her own living rhythm called the "Personal Tempo." It is the basic rhythm observed in our voluntary actions, such as tapping on a table. Although our tempos are basically homeostatic, they can change in a certain width according to our psychological conditions, and we feel uneasiness when our tempos change even slightly. In this research, a control method of individual action by controlling the personal tempo is proposed. Drum beat patterns are used to control the personal tempo. We show the effectiveness of this method by applying this to cooking, especially chopping by a knife.



We apply this method to control two-person action, e.g., conversation by coordinating their tempos. In this case, we provide a listener with a speaker's personal tempo by vibration of a loudspeaker cone before conversation. Through evaluation experiment, this method can control the listener's nodding and supportive response to make conversation smooth.



(3) Fashion Coordination Support System

Existing fashion coordination support systems supports users in front of the computers on the desks, but we believe fashion coordination should be supported in front of closets. The system we propose consists of software agents which correspond to clothes in a closet. After a user specifies the today's feeling by selecting a corresponding image color and goes into the closet, the agents start to claim to choose themselves. For example, they claim "Recently you have not worn me. Wear me today" and "Today you have a date, so please select me because the last date was good with me." To do this, the agents refer to histories of use, climate data and user's schedule of the day, and color matching knowledge. When the user selects one of the clothes, other clothes counterclaim "I am better because ..." Selected cloth is identified by reading a IC tag on a hanger. We have a plan to provide the agents with different characters according to their colors, which changes the type of claiming.