JAMIOLAS: Supporting Japanese Mimicry and Onomatopoeia Learning with Sensors

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Abstract

This paper proposes a computer supported ubiquitous learning environment for language learning. Especially, this paper describes context-aware language-learning support system for learning Japanese mimicry and onomatopoeia (MIO) words, which is called JAMIOLAS (Japanese Mimicry and Onomatopoeia Learning Assisting System). This system provides learner the appropriate MIO expressions deriving the learner's situation and sensor data. Phidgets is used as sensors in order to get real-world data from the physical world, e.g., temperature, humidity, etc. This paper describes the implementation, the interface and usage scenario of JAMIOLAS.

Keywords: Mimicry word, onomatopoeia, sensor, Phidgets, ubiquitous learning, mobile learning.

1. Introduction

Context-aware computing [1] will help in the organization and mediation of social interactions wherever and whenever these contexts might occur [6]. Its evolution has recently been accelerated by improved wireless telecommunications capabilities, open networks, continuous increase in computing power, improved battery technology, and the emergence of flexible software architectures. With those technologies, an individual learning environment can be embedded in daily real life. The main characteristics of ubiquitous learning are shown as follows [3,4]:

(1) Permanency: Learners never lose their work unless it is purposefully deleted. In addition, all the learning processes are recorded continuously everyday.
(2) Accessibility: Learners have access to their documents, data, or videos from anywhere. That information is provided based on their requests. Therefore, the learning involved is self-directed.
(3) Immediacy: Wherever learners are, they can get any information immediately. Thus, learners can solve problems quickly. Otherwise, the learner can record the questions and look for the answer later.
(4) Interactivity: Learners can interact with experts, teachers, or peers in the form of synchronies or asynchronous communication. Hence, the experts are more reachable and the knowledge becomes more available.
(5) Situating of instructional activities: The learning could be embedded in our daily life. The problems encountered as well as the knowledge required are all presented in their natural and authentic forms. This helps learners notice the features of problem situations that make particular actions relevant.

This paper focuses on applying CSUL to language learning because of the following reasons:

(1) Language learning is life-long activity, and it can need to be supported by computers permanently.
(2) Language learning takes a place in any time at any place. Therefore, learners need the high accessibility to get information.
(3) If learners have problems in conversations, they will need immediate help.
(4) Learners can need interactive support from experts or peers, because they have to explain the current situation.
(5) Language learning is strongly influenced by situations.

Therefore, we are investigating on computer supported ubiquitous language-learning [10]. For example, we have developed TANGO (Tag Added Learning Objects) [11] system to support vocabulary learning, and also JAPELAS (Japanese Polite Expressions Learning Assisting System) [12] to support polite expressions in Japanese. In addition, CLUE (Collaborative Learning support system in Ubiquitous computing environments) [13] has been proposed to learn Japanese expressions by location based support.

This paper proposes the context-aware language-learning support system called JAMIOLAS (Japanese Mimicry and Onomatopoeia Learning Assisting

System). Users of this system are mainly overseas students of Universities in Japan, who are learning Japanese language as the second language. Although, most of them have some experience to read, write and speak in Japanese more or less, they have to take an intensive Japanese-language course for six months before entering the University. However, it is not enough to acquire all kind of knowledge through the course. In addition, there are a lot of dialects in Japan. Therefore, they have to get fluent in Japanese though the practice in their daily life. In this system, overseas student takes a computer with sensors, and JAMIOLAS provides him/her the appropriate MIO expression in the context that is derived from the Phidgets [5] sensors.

As for the previous research, Ochi et al [9] developed the knowledge base system for Japanese MIO expression learning, which is called JAMIOS (Japanese Mimicry and Onomatopoeia Dictionary System). JAMIOS is a multimedia dictionary for supporting the learning of changes of MIO expressions in different situations. After the user inputs the situation and selects a MIO word, JAMIOS shows the meaning, examples, etc in that situation. Therefore, this paper tackles with context-aware support in the conversation in everyday life without any input of the context information.

2. CSUL (Computer Supported Ubiquitous Learning)

2.1 What is CSUL?

CSUL (Computer Supported Ubiquitous Learning) is defined as a ubiquitous learning environment that is supported by embedded and invisible computers in everyday life. The CAL (computer assisted learning) systems using desktop computers are not embedded in the real world, and are difficult to move. Therefore, those systems hardly support learning at anytime and anywhere.

Compared with desktop computer assisted learning, mobile learning is fundamentally about increasing learners' capability to physically move their own learning environment with them. Mobile learning is implemented with lightweight devices such as PDA, cellular mobile phones, and so on. Those mobile devices can connect to Internet with wireless communication technologies, and enable the learning at anytime and anywhere. In this situation, however, computers are not embedded in the learner's surrounding environment, and they cannot seamlessly and flexibly obtain information about the context of his/her learning [7].

In pervasive learning, computers can obtain information about the context of learning from the learning environment where small devices such as sensors, pads, badges, and so on, are embedded and communicate mutually. Pervasive learning environments can be built either by embedding models of a specific environment into dedicated computers, or by building generic capabilities using computers to inquire, detect, explore, and dynamically build models of the environments. However, this makes availability and usefulness of pervasive learning limited and highly localized.

Finally, ubiquitous learning has integrated high mobility with pervasive learning environments. While the learner is moving with his/her mobile device, the system dynamically supports his/her learning by communicating with embedded computers and sensors in the environment. As for the broad definition of ubiquitous learning, both pervasive learning and mobile learning would be in the category of ubiquitous learning. RFID tags are often used to realize pervasive computing.

From the human computer interaction perspective, a ubiquitous computing environment enables people to learn at any time and any place. Nevertheless, the fundamental issue is how to provide learners with the right information at the right time in the right way [7]. This paper tackles the issues of right time and right place learning (RTRPL) in a ubiquitous computing environment.

2.2 Learning Theories for CSUL

CSUL is advocated by pedagogical theories such as on-demand learning, hands-on or minds-on learning, and authentic learning [3,4]. CSUL system provides learners on-demand information such as advices from teachers or experts at the spot at the precise moment they want to know something. Brown, Collins, and

Figure1. Examples of onomatopoeia for raining.

Duguid [2] define authentic learning as coherent, meaningful, and purposeful activities.

We believe that language is mainly acquired through authentic learning. Miller and Gildea [8] worked on vocabulary teaching, and described how children are taught words from dictionary definitions and a few exemplary sentences. They learned lots of words outside school normally. Therefore, we believe that it is very important to support language learning in their everyday life with ubiquitous computing technologies.

3. JAMIOLAS

3.1 Mimicry and onomatopoeia expression

Japanese language is very rich in mimicry and onomatopoeia (MIO) words. Mimicry words are imitating situations and body movements. For example, "uro uro suru" means walking aimlessly around there. On the other hand, onomatopoeia shows sounds of something, e.g., animals, natural phenomena, etc. For example, "gaya gaya suru" means very noisy situation. Japanese language has about 2,000 MIO words. If students can use these expressions correctly, their conversation will be more rich, natural, emotional and lively. For example, MIO words are often used in word balloons in Japanese cartoons, "Manga." In addition, those words are much related to Japanese culture itself. Therefore, learning MIO words are very useful not only to have rich communication with Japanese native speakers, but also to understand Japanese culture.

Generally, four skills (reading, writing, hearing, and speaking) are main objectives in language learning. Because time is limited in Japanese language learning course for overseas students, only a few onomatopoeia words could be taught. Therefore, students have to acquire more words in their daily life. However, it is very difficult to learn those words because the expressions vary according to the situation. If the expressions are not used properly, they might sound comical and strange. Moreover, it might lead to misunderstanding in conversation. Therefore, it is very important for foreigners to have the solid understanding of the situation.

Japanese MIO expressions mainly have following features:

(1) It is very difficult to express the meaning of MIO words, because their expressions are based on some senses such as hearing, vision, touch, taste, smell, and spirit. For example, onomatopoeias for raining vary depending on the sound of rain, as shown in figure 1.

(2) MIO words have many synonyms and much assonance. For example, "Pyuh Pyuh", "Hyuh Hyuh" and "Byuh Byuh" mean sounds of wind either, but they are used in slightly different situation. Therefore, overseas students have difficulty in using them adequately.

(3) Like "bochi bochi", most of MIO words consist of twice repetition of one word and they are written in Hiragana or Katanaka, not in Kanji (Chinese characters). Therefore, it is easy to understand them in a written form, but it is very difficult to understand and use them correctly in conversations.

The usage of MIO words depends on the situation where the speaker is. Therefore, this paper proposes JAMIOLAS to support learning MIO words using sensors, which detects the speaker's situation. Especially, Phidgets are used because it is easy to connect to PC and to control with program languages.

3.2 Phidgets

Phidgets (physical widgets) are "*building blocks that help a developer construct physical user interfaces. The philosophy behind Phidgets is that just as widgets make GUIs easy to develop, so could Phidgets make the new generation of physical user interfaces easy to develop*." Phidgets can send information to PC from sensors such as force sensor, temperature sensor, humidity sensor, IR distance sensor, light sensor, motion sensor, touch sensor, RFID tag reader and etc; also they can control servo motors and LED lights (see figure 2).

Figure 2. Phidgets sensors and controllers. (http://www.phidgets.com)

3.3 Implementation

We have developed the prototype system of JAMIOLAS on a Tablet PC (HP T1100) with Windows XP, and wireless LAN (IEEE 802.11b). The program has been implemented with Visual Basic 6.0. As shown in figure 3, the user brings a PC with Phidgets sensors that are attached in his closes.

Figure 3: Usage Scene of JAPELAS.

As shown in figure 4, JAPELAS has the following modules:

Learner model: This module has the learner's profile such as name, age, gender, occupation, interests, etc, and the comprehensive level of each expression. Before using this system, each learner enters those data. In addition to the explicit method, the system detects learner's comprehensions during the system use.

Environmental model: This module has the data of physical environment. For example, the system identifies whether the user is indoor or outdoor using RFID tag and GPS. The location is used to determine the formality.

Educational model: This module manages the expressions as learning materials. Also it links the expression with sensor data. Teacher enters the basic expressions and sensor data. Both learners and the teacher can add or modify them during the system use.

Communication: If the user has a question about the words, s/he can talk to teachers or peer students with skype or messenger.

Sensor manager: With sensors of Phidgets, RFID tags and GPS, this module detects which sensors can be used currently. After getting data from the sensors, this module sends it to the environmental model.

Adaptation engine: Based on the sensor data and the learner model, this module provides the appropriate question for this situation.

Dictionary: The system has Japanese mimicry words and onomatopoeia dictionary, which includes the meaning, examples, synonyms, paintings, audios, and movies, etc.

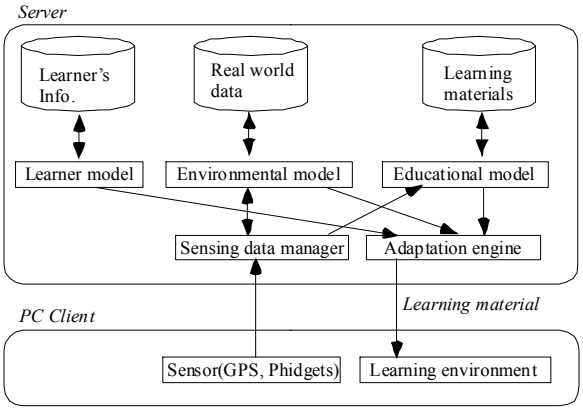

Figure 4. System configuration.

3.3 User Interface

As shown in figure 5 (A), the system asks a question to the user according to the data of the rain sensor. In this case, the question is how it rains now. After the user selects one word from the list, the system tells whether the answer is correct or not. By double clicking a word in the list, the control window appears like (B). From this window, detailed information will be provided by pushing the buttons. For example, the usage situation is explained with the painting in the right upper window in figure 5. In addition, the user can change the sensor data using a slider in order to learn similar MIO words in different situations. For example, if it is high humidity in the user's situation, it can be described "mushi mushi suru." However, if the user changes to the sensor data for the low humidity, the user can learn "karari to suru."

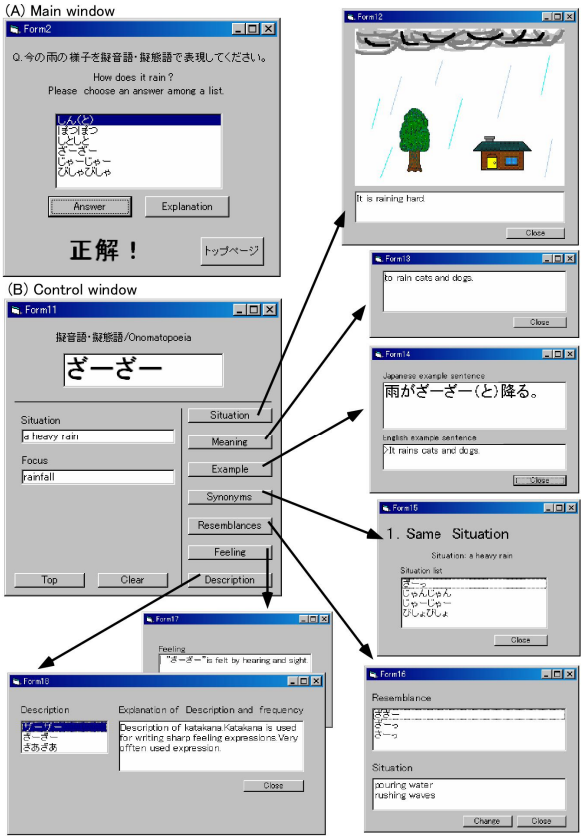

Figure 5: User Interface of JAPELAS.

5. Conclusions

This paper described a context-aware language-learning support system for learning Japanese mimicry and onomatopoeia expressions, which is called JAMIOLAS. The system provides the right MIO expressions that are derived from sensors.

As for the future work, this system requires the user to input the verb s/he wants to speak. Therefore, we will try to adapt natural language interface to detect the verb in the future research without any input from the user. In addition, software agent will be introduced as conversational partners. The agent will enable collaborative learning when learner is alone. Moreover, JAMIOLAS can deal with some MIO words using Phidgets sensors, e.g., rain, temperature, wind, humidity. Therefore, we will increase MIO words that the system can help to learn. Finally, we will conduct an evaluation.

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