Development of Web-based Japanese Mimicry and Onomatopoeia Learning Assistant System with Sensor Network

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Abstract— In this paper, we propose a web-based Japanese mimicry and onomatopoeia learning assistant system (JAMIOLAS). In our previous studies, we have proposed context-aware language learning assistant systems that used wearable sensor and sensor network respectively, and attended good results. In order to use this learning model in broader area and more general scene, we are trying to realize the system on website, and using on-line information as sensor data from global sensor network. Besides, in order to support more words, we are also using on-line multimedia such as video or picture to create the context for learning.

Keywords-mimicry; onomatopoeia; sensor; language learning; context-aware learning; ubiquitous learning

I. INTRODUCTION

Context-aware computing [1] will help in the organization and mediation of social interactions wherever and whenever these contexts might occur [2]. Context-aware computing makes it possible to learning foreign language words related to people's feeling more comfortably.

Computer Supported Ubiquitous Learning (CSUL) has integrated high mobility with embedded computing environments [3,4]. We are focusing on applying CSUL to language learning and are investigating computer supported ubiquitous learning [4]. We proposed context-aware language learning assistant system called JAMIOLAS [5-7] for learning Japanese mimicry and onomatopoeia (MIO) words. The previous two studies used wearable sensors and sensor network respectively to detect the context automatically and achieved certain effect. However, it still cannot meet learner needs. Therefore, in this paper we propose an improved system named JAMIOLAS 3.0 that can support learning MIO by using sensor data.

II. JAPANESE MIMICRY AND ONOMATOPOEIA

Mimicry words are imitating situations and body movements while onomatopoeia shows sounds of something [7]. Japanese is very rich in it. It is very important but very difficult to learn because of following aspects:

- Explanation: Nearly all of MIO words are just feeling of Japanese.
- Translation: Difficult to find the word that has the exactly same meaning in other language.
- Writing: Most of MIO words are written in hiragana or katakana (Japanese syllabify), not in kanji. It is easy to pronounce but difficult to understand.
- Hearing and Saying: The pronunciation of MIO usually has twice repetitions. It may cause the illusion of hearing and judge the different words as same one.
- Meaning: MIO words have many synonyms and much assonance.
- Situation: Some are only used in specific situation. For example, "jime jime" means muggy, dump and humid, but it almost be used only in a rainy season.

Most of the MIO words are used to describe the speaker's feeling. In order to know the speaker's feeling, we attempt to acquire user's context with sensor.

III. JAMIOLAS 1.0 AND 2.0

JAMIOLAS 1.0 is implemented by wearable sensors called Phidgets (physical widgets) [8] and a Tablet PC (HP T1100) . When learning, the learner must wear Phidgets connected to the system, and select a MIO as answer that is most suitable for the situation in the question generated by system. However, when learning, sometimes learners do not know where he/she could learn the MIO. Learner must carry the system when using it, so it is not so convenient.

JAMIOLAS 2.0 use the wireless sensor network instead of wearable sensor, and use RFID to recognize user's position. However, most of MIO words cannot be supported by it, and it can only be used in limited area. For these issues, we propose JAMIOLAS 3.0 to support learning MIO.

IV. JAMIOLAS 3.0

A. *Context and sensor*

There are three important aspect of context: Where you are, who you are with, and what resources are nearby [9]. Context includes not only user's location, but also the lighting, noise level, social situation and so on [10]. Human being usually gets the feeling from environment by five senses including seeing, hearing, smelling, tasting and touching. It is possible to get such context with sensors. The context can be classified as two types – can be created by computer (scene, sound) and cannot be created by computer (weather).

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TABLE I. RELATIONSHIP BETWEEN BODY SENSE, CONTEXT AND SENSOR

Body Sense	Context	Sensor
Seeing	Light	Light Sensor
	Scene	Image Sensor
Hearing	Sound	Sound Sensor
Feeling	Temperature	Temperature Sensor

B. *Implementation*

Figure 1 shows the architecture of system. The weather information and media files are learning stuff in this system. We are using real-time on-line weather service as sensor network. As the feeling is different one by one, the system will use the voting mode to decide the proximate select to the weather or media. We plan to use mobile as client, but for limitation on condition, we have to implement this system on web side at current.

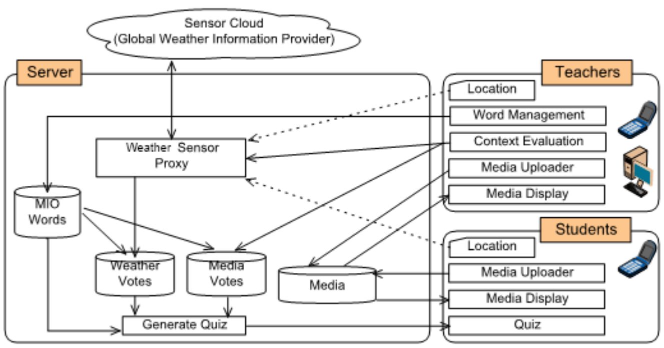

Figure 1. System architecture

C. *System interface and function*

1) Student's interface

This system mainly supports the following functions for students.

- Learning by weather information: There are two modes: Fix mode - system will show uses user's default location, and generate a quiz to ask learner how to describe the current weather with MIO; Tour mode - learner must set the coordinate first. When learner gave a right answer, he/she can view the example and media for each selection or enter the test mode to take a test.
- Learning by media: Learner choose a media file and give select a MIO word that is most suitable for this media. Finally there is a test function for learner
- Learning in free mode: the free mode likes a media dictionary, user can look up a word and the result is composed of examples and media.

Figure 2 shows a typical learning flow in this system.

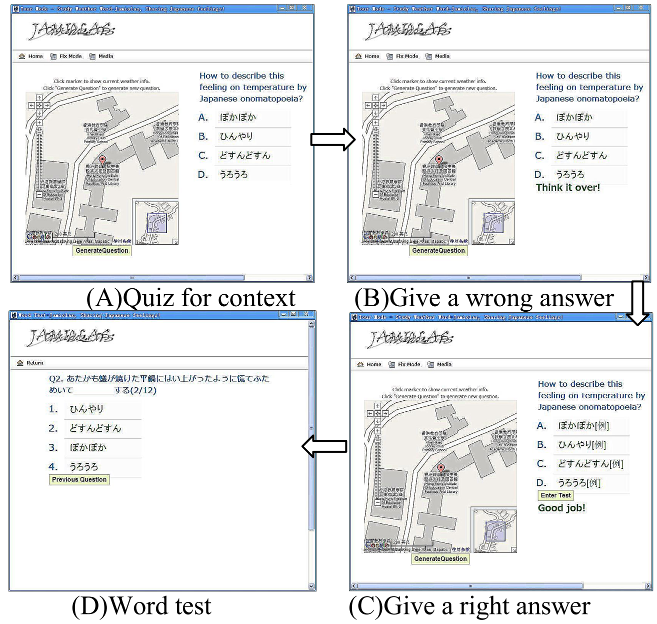

Figure 2. Student's interface

2) Teacher's interface

The teacher can use all the functions available for students. In addition, the teacher has access to another two functions.

- Evaluate weather/media: The teacher can vote a word for weather/media. There are some restrictions for evaluation. The user who has the role of teacher can only vote for the weather once within one hour unless the weather information has been updated. And each media file can only be voted for once by each user.
- Word management: The user who has the role of teacher can manage words. This function contains the common CRUD (create, retrieve, update, delete), word example management, and weather word management.

V. EVALUATION

A. *Method*

We have done an experiment to compare JAMIOALS 3.0 to traditional method. After voting by Japanese students, we planned to prepare 10 words as test data in this experiment (Table II). 6 Japanese learners took the part of student. In them, 1 is living in Tokushima (Japan), 3 are living in Tokyo (Japan) and 2 are living in Dalian (China). They were divided into two groups: one used dictionary first, and another used system. After 20 minutes, they exchanged, and continue to learn for 20 minutes. We put pre-test, mid-test and post-test in this experiment. Finally, they answered a questionnaire that is 5 ranges from 1 to 5.

TABLE II. MIO USED IN THE EXPERIMENTATION

Context	MIO
Weather(Temperature)	hinyari, nuku nuku
Scene(Posture of walking)	uro uro, tyoko tyoko, noshi noshi, yochi yochi
Sound(Sound of animals)	ka ka, ga ga, gero gero, tyun tyun

B. Result

We did three tests for each learner during the experiments and administered a questionnaire. These supplied us with our experimental data. Although this is an initial experiment, with the analysis of the experimental data we can see the following results.

1) The overall results

The following chart (Figure 3) shows the results of the pre-test, mid-test and post-test.

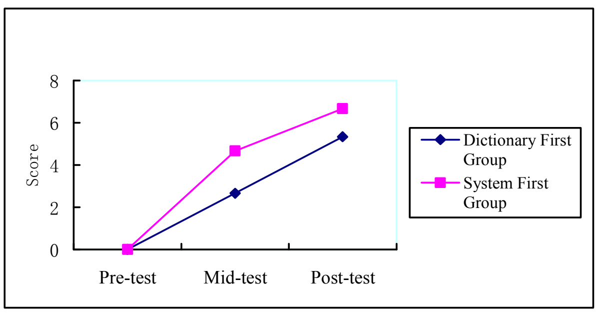

Figure 3. Average increased score in the experiment

Figure 3 shows the average score increases in the mid-test and post-test. As shown in this figure, the system first group showed better increased score than the dictionary first group. After the mid-test and the group changeover, the final results from the system first group were higher than for the dictionary first group. Although the data from this small sample size would not bear statistical analysis, the results suggest that JAMIOLAS 3.0 can be more effective than a dictionary for learning MIO.

From feedback, we learned that when users in the system first group used JAMIOLAS 3.0 from the beginning, both the system and the words were new to them, and they made full use of system. However, when users had first learned the meaning of words from the dictionary, they lost the freshness of the words, so they felt that they had already understood the meaning and the system was underutilized. In the questionnaire, most learners suggested we add the meanings in the system, and the system should provide an explanation when the results are shown.

2) Results on type of context

There were three types of context in the evaluation experiment. We used the mid-test data to plot this in order to see the effects of the systems for different types of context.

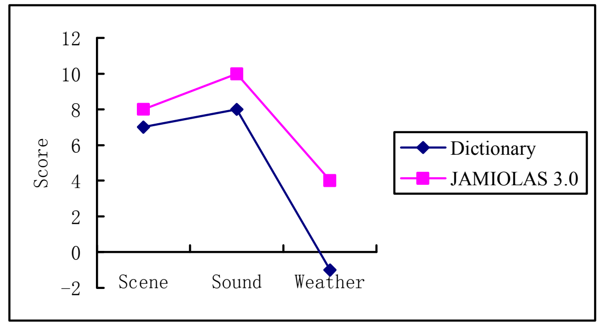

Figure 4. Total increased score on type

Figure 4 shows the increase in score for each type of context. All three types were learned better by using the system than by using the dictionary. It shows that words related to sound (onomatopoeia) showed the highest increase in score both by the dictionary and the system. For the weather context, only the system provided benefit; in this experiment, the dictionary had no effect on learning the words related to weather. On the contrary, one learner changed their original right answer into a wrong answer after learning the weather words using the dictionary and got a lower score. This suggests that the dictionary cannot effectively explain MIO related to weather.

3) Questionnaire

Table III shows the results of the questionnaire. According to Question (1), we learned that the system is helpful for learning mimicry and onomatopoeia. The highest average score and lowest standard deviation of Question (1) in the questionnaire shows the system is generally considered useful. Question (2) asked whether the answers of the presented quiz were appropriate to the situation or not. In this case the result was less satisfactory, it demonstrates the biggest problem of learning MIO is with feelings, because by the standard deviation we can see the feeling is different depending upon the person. Therefore, in the future we should seek for a method to make the words more appropriate to the situation.

TABLE III. RESULT OF QUESTIONNAIRE

	Question	Avg	SD
1	Were you able to learn mimicry and onomatopoeia by this system?	4.8	0.4
2	Was the answer of the presented quiz appropriate to the situation?	3.8	0.8
3	Were you able to learn mimicry and onomatopoeia with enjoyment?	4.2	0.8
4	Is the system easy to use?	4.2	0.8
5	Do you want to learn by using this system in the future?	4.3	0.5
6	Which do you think enhances learning more, this system or traditional learning? (this system: 5, traditional learning: 1)	4.5	0.5

Results to Question (3) showed learners were able to effectively learn using this system, which can motivate them to learn language. For Question (4), most learners thought this system was easy to use. Question (3) and Question (4) also have high standard deviations, and these tell us that we must improve the interface of system and provide better learning experience. Question (5) shows that users like using this kind of system and would use it again. Question (6) shows that compared to traditional learning; most learners thought this system was more effective for learning MIO.

Apart from the above questions, we also asked for feedback regarding the difficulties users encountered as they were learning MIO. All of them said the words were difficult to remember, but two of the users could not explain why. Others said there are too many MIO words, and they could not guess the meaning using the limited information. In addition, although users had learned the meaning, because they had no intuitive feeling and no environment, it was easy to forget MIO words. These answers will help us to improve the system in future work. We also asked the learners to make some general comments on the system. One user said this system was very interesting, they could easily learn the meaning the words in an environment, and it is a really good way to explain the MIO words by feeling. Most of users said when the answer of a quiz is given, they could only see what was right or wrong, but could not learn why. If the meaning could be shown at that time, it will be more conducive to remembering the words. One user said that in the test there were sometimes too many questions for one word. This is in fact a result of the current algorithm, which we can improve in the future. Another user also said the video was not so clear; however this problem cannot be solved at present because of the limitation of technology.

During the evaluation, we learned that the system can explain the words that related to feeling very well by sensor data, and that learning efficacy and quality are better than traditional learning.

VI. CONCLUSION AND FUTURE WORK

In this paper, we described an improved context-aware learning system named JAMIOLAS 3.0 that can support the learning of Japanese MIO words in a sensory learning mode with global sensor network. This is an on-line system that can be used in a broader area than previous versions. It uses on-line weather information as global weather sensor data. In addition, it also uses media (video/audio) as image/sound sensor data and can support learning more words than before. Two methods are used in this system: created context and detecting context automatically to provide the right MIO for the learner's context. Through an initial evaluation experiment, we can see that this system is effective for learning MIO. The feeling related to a weather situation can be explained by the system more effectively than by dictionary. However, on the media side, although the media can be explained by the system better than by the dictionary, the results and feedback suggest that the dictionary is still useful. With the help of the dictionary, a learner can learn the words using both meaning and feeling. In the future, we will focus on making the questions more appropriate to environment and weather data, and we will also consider how to use multiple conditions of weather information.

Our future research will be in the following directions:

- Using embedded mobile sensors to acquire sensor data anywhere at any time. The current system is not using sensors that we have deployed, but the sensor data is received from the global sensor network that is supplied by an on-line weather provider. In the future, sensors will be embedded in each mobile, as users' phones will know a lot about the world around them [11,12]. Our future plan is to support Japanese MIO learning with the sensors that have been embedded in the next generation of mobile technology, especially mobiles using the Android operating system [13]. Android has already supplied an API for 8 types of sensor including accelerometer, gyroscope, light, magnetic field, orientation, pressure, proximity and temperature sensors [14,15].
- Introducing biosensors to support learning MIO related to emotion. Because most MIO are just used to describe one's feelings, there are many words related to emotion, but these cannot be supported by the current system. One way to recognize the emotion is using biosensors to acquire information from the human body [16].

In addition, we must look for an approach to making the questions in the system more appropriate to the learning context. We should also consider how to introduce the meaning of words into the system more effectively. However, we will improve the system and conduct further evaluations to gather more experimental data.

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