Supporting Japanese Mimetic Words and Onomatopoeia Learning with Wireless Sensor Networks for Overseas Students

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Abstract: This paper proposes an improved context-aware language supported system for learning Japanese mimetic words and onomatopoeia (MIO) using wireless sensor network "MOTE". In our previous work, a learner wears sensors so that the system provides the appropriate MIO expressions at his/her place. In this current system called JAMIOLAS (Supporting Japanese Mimetic words and Onomatopoeia Learning with Sensors for Non-Japanese) 2.0, MOTE is used to get appropriate data from the environment, for example, temperature and light. The system recommends the right place for the right person to learn the right MIO expressions. This paper describes the implementation, the interface and usage scenario of JAMIOLAS 2.0.

Keywords: mimetic word, onomatopoeia, wireless sensor network, ubiquitous learning, mobile learning

Introduction

Context-aware computing [1] will help the organization and mediation of social interactions wherever and whenever these contexts might occur. 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 life.

Computer Supported Ubiquitous Learning (CSUL) has integrated high mobility with embedded computing environments [2][3]. 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. RFID (Radio Frequency Identification) tags are often used to realize pervasive embedded computing. It is expected that the sensor becomes one of the key technologies to solve social problems in the 21st century.

We focus on applying CSUL to language learning and are investigating computer supported ubiquitous learning [3]. We proposed a context-aware language-learning support system for learning Japanese mimetic words and onomatopoeia expressions, which is called JAMIOLAS [4][5]. The learner wears sensors and s/he can learn MIO with this system. However this system has several issues, for example, the learner can learn MIO only at the

spot. It is considered that we should install sensors in various places in order to solve these issues. Therefore this paper proposes an improved JAMIOLAS system with wireless sensor network, which is called JAMIOLAS (Supporting Japanese Mimetic words and Onomatopoeia Learning with Sensors for Non-Japanese) 2.0.

1. Mimetic words and onomatopoeia expression

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

Generally, 4 skills (reading, writing, listening, and speaking) are main objectives in language learning. Only a few MIO could be taught in Japanese language learning courses for international students because of time limitation. 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 non-Japanese to better understand the situation.

Japanese MIO expressions mainly have the following features:

(1) It is very difficult to convey the meaning of MIO, because the 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 have many synonyms and much assonance. For example, “pyuh pyuh”, “hyuh hyuh” and “byuh byuh” mean sounds of wind, but they are used in slightly different situations. Therefore, international students have difficulty in using them adequately.

(3) Most of the MIO consist of repetition of one word and are written in Hiragana or Katakana, not in Kanji (Chinese characters). Therefore, it is easy to understand them in written form, but very difficult to understand and use them correctly in conversations.

The usage of MIO depends on the situation. Therefore, we proposed a system to learn MIO using sensors, which detect the speaker’s situation. We describe this in the following section.

Figure 1. Examples of MIO for raining

2. JAMIOLAS and its issues

We developed the JAMIOLAS system in our previous research. This system supports learning MIO using a sensor called Phidgets. The learner wears Phidgets connected to the system, and the system can receive information as digital data from the environment around the learner. The system presents a question about MIO, suitable for the situation according to the received data, and the learner can learn MIO. However JAMIOLAS has following limitations:

(1) The learner might not be able to know what kind of MIO can be learnt from other places by using the system. Therefore the learner may miss out on learning opportunities.
(2) There is a possibility that the learner becomes worried because s/he needs to carry the system.
(3) There is a possibility that the learner must go around in a blind way in order to look for places to be able to learn MIO.

We should install sensors in various places in order to solve these issues. Therefore this paper proposes JAMIOLAS 2.0 supported learning MIO with wireless sensor network "MOTE".

3. JAMIOLAS 2.0

3.1 Wireless sensor network "MOTE"

A wireless sensor network is defined as a "*network of autonomous dispersion type which can collect information without wire using sensor nodes in real time*". In this paper, we use "MOTE" [6], as a wireless sensor network. The gateway of MOTE acquires data automatically just to put sensor nodes at every spot. The sensor node will respond to temperature, illuminance, sound, and so on.

3.2 Implementation

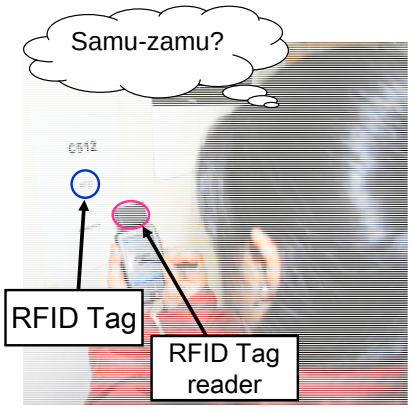


Figure 2. Usage scene

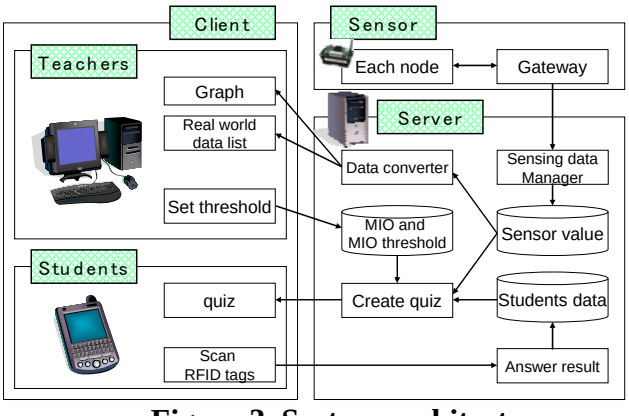


Figure 3. System architecture

We have developed the prototype system of JAMIOLAS 2.0 on Pocket PC with Windows Mobile 5.0, Server with LAMP (Vine Linux 4.1 + Apache2 + PHP5 + MySQL5), RFID tags reader/writer, and MOTE. The program has been implemented using Visual C# 2005.

As shown in Figure 3, JAMIOLAS 2.0 consists of a main client-server and sensor components. The client consists of the computers used by Japanese-language teacher and the PDAs used by the students outside the classroom. On the other hand, the server can be divided into two main parts, namely the interface and the data processing component. The database stores sensor value, MIO, MIO thresholds and students' data.

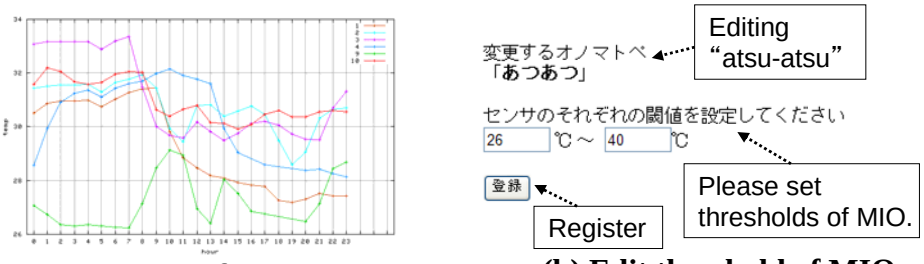
3.3 System interface and function

✧ *Teacher's interface*

As shown in Figure 4, JAMIOLAS 2.0 for the teacher has the following functions:

(2) Function to support setting threshold of MIO: This system needs to set the threshold of MIO by Japanese feeling. However it is difficult to set the threshold, without referring to anything. The system can set the threshold by varied functions, for example, line graph as shown in Figure 4(a), list of real world data. The line graph can visualize real world data stored in the database on an hourly, a daily or monthly basis. Figure 4(a) is a line graph about temperature on one day at each place where there is a sensor node. The list of real world data can look at quantified real world data in the database, and has a search function.

(3) Set threshold of MIO: The teacher can look over all registered MIO and their kind and threshold. S/he can select MIO from the list and set their threshold, for example, the threshold of "atsu-atsu" is from 26 to 40 degrees centigrade as shown in Figure 4(b). In this case, it is highly probable that each teacher will set piecemeal threshold because multiple teachers set it. To solve this problem, the system selects MIO of the majority in coincident MIO between thresholds that each teacher sets when learners are using the system.



(a) Line graph of temperature **(b) Edit threshold of MIO**

Figure 4. User interface for teachers

✧ *Student's interface*

As shown in Figure 5, JAMIOLAS 2.0 for students has the following interface:

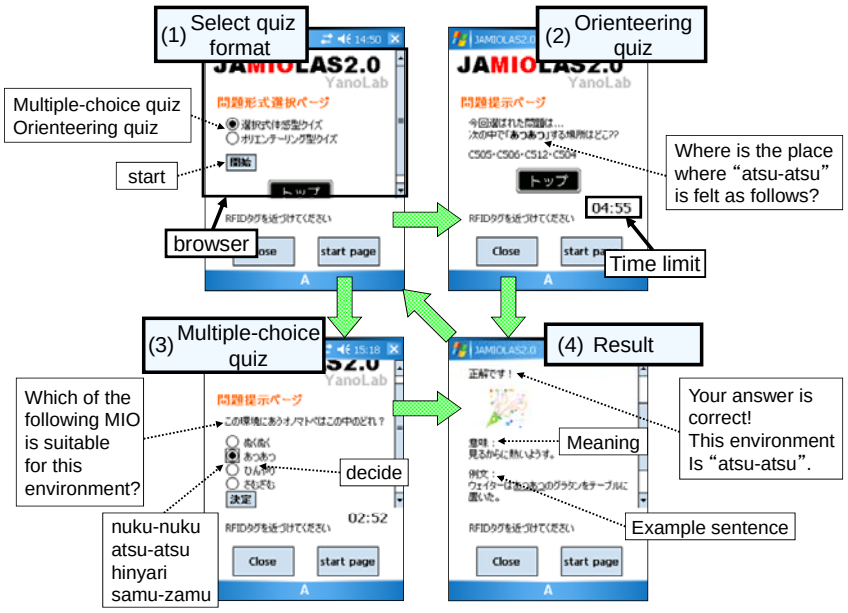


Figure 5. User interface for student

(1) Select quiz format: The student can select either a multiple-choice quiz or orienteering quiz from the quiz format. When the student selects the multiple-choice quiz, the screen page of the PDA displays the page, and the student can go freely to the spot where there is an RFID tag and node of MOTE. When the student selects the orienteering quiz, the screen of the PDA displays a page of the orienteering quiz.

(2) Orienteering quiz: When the student selects the orienteering quiz, the screen of the PDA displays this page. The system presents one MIO and multiple spots containing a node of MOTE and an RFID tag. For example, as shown in Figure 5(2), when the system selects "atsu-atsu" from C506, it presents "atsu-atsu" as MIO, C506 as the answer and other places as dummy. The student looks for and goes to the spot where s/he can feel MIO suitable for the situation from the multiple spots.

(3) Multiple-choice quiz: When the student goes to the spot where there is a node of MOTE and an RFID tag and scans it with the RFID tag reader attached to the PDA, the screen of the PDA displays this page. As shown in Figure 5(3), the system presents "atsu-atsu" as the answer and other MIO as dummy. The student selects the MIO suitable for the spot where s/he is now from multiple MIO presented by this system.

(4) Result: The screen page of the PDA displays the result. When the student chooses the correct answer, the system presents the meaning and example sentence of the MIO. As a result, the student can deepen his/her understanding about the MIO. When the student chooses the wrong answer from the multiple-choice quiz, the system recommends the spot, where s/he can learn the MIO that s/he selected.

Each quiz has a set time limit and the screen page will display the remaining time. In addition, MIO selected by the system appear at random based on the threshold that each

teacher set. The system changes the appearance ratio of the MIO with the level of understanding of the student.

4. Conclusion and future work

This paper described an improved context-aware language-learning supported system for learning Japanese mimetic words and onomatopoeia expressions with a wireless sensor network, named JAMIOLAS 2.0. The system provides the right MIO expressions from the received data via sensor nodes at the learner's place.

As for future work, the system needs to improve the user interface to make it more user-friendly. For the teacher, the interface of this system will be improved so that the threshold can be set easily, for example, the teacher can set thresholds while referring to the function to support setting them and comparing with other settings. The interface of this system will be improved for non-Japanese users. Furthermore, the number of MIO used in this system will be increased. In addition, the system will be improved in a way that the teacher can register new MIO. Finally, we will conduct an evaluation experiment again.

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