

LE-Story: An Intelligent Storytelling Environment for Chinese Learning

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Abstract: A story is a narrative structure with a high cause and effect context which enables the story to make an enduring impression on people. For this purpose, many language learning environments use storytelling as foundation to increase degree of understanding and learning interest. However, most current storytelling systems in language learning have little flexibility in the connection between the course content and the storytelling resources. In this paper, we have developed an intelligent storytelling system which is used to adapt the ‘after school practice’ concept for Chinese language learning called *LE-Story*. This system uses lively events (LEs), which are derived as an empirical result of our project survey, as basic course units. The students can choose these events and produce their discourse about daily life. In this system, we focus on the process of storytelling by the students. Students can compose a sentence from phrases for language exercise. The system uses the ‘drag and drop’ method to prevent the improper usage of the phrases in the storytelling process. The system uses web ontology language (OWL) to present our LEs and students’ stories.

Keywords: Storytelling system, narrative, ontology, lively event, Chinese learning

Introduction

There are many typical storytelling systems for young children focus on the analysis of education and entertainment effects, such as SAGE, KidPad, Klump, Rosebud and StoryRooms [2][3][4][7]. Wang et al. created a 3D-storytelling system with multi-model interaction based on speech and pen-gesture for Chinese children [9]. Yearwood et al. developed a narrative-based interactive intelligent learning environment which is used in training novices in decision-making [10]. In foreign language learning, Tsou et al. created a storytelling website and indicated that the process of storytelling helps students to comprehend the story and recall the story structure [8]. In computer programming learning, Caitlin et al. describe a programming environment called Storytelling Alice that introduces middle school girls to computer programming, and participants who used the Storytelling Alice spent a greater percentage of their time in programming than those who used the traditional Alice [1][11]. Much work in the literature focuses on ontology support for the storytelling system. Nakasone et al. provide an interest-based storytelling model and use Rhetorical Structure Theory to organize the story events, using not only arbitrary relations but also relations determined by the rhetorical context of the events [5]. Paul et al. developed architecture for building speech-enabled conversational agents with the ability to provide inference processing on WordNet, FrameNet, and the Open Mind [6].

In this paper, we implement a storytelling system to allow lively events (LEs) to be added into the story. The system assists the students to make a story for the Chinese language practice. The sentence pattern is generated by the LE and the students can carry

out a ‘drag and drop’ operation to customize the key words, such as the frame elements and event frames. The drag and drop is a way to prevent some phrase errors occurring in key words substitution when the students make sentences in storytelling. We design a structural LE-Ontology which is the prototype used in the system to help students to weave their story. The event instances can be authored by teachers and are well-connected with the course content and close to the student’s life. We also define the sub-elements, such as script, frame, frame element and event frame, and choose the OWL format to represent the whole LE structure. The system can check the event frames to ensure that the pairs of noun-verbs are proper by fetching the LE-Ontology. In Figure 1, we show an example of frame content with two frame elements *Argument 0* and *Argument 1* and they involve many phrases each one in itself a replaceable resource. The {VNPair} tag indicates that Argument0 and Argument1 are event frames.

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我要{Argument0:搭;騎;坐;開;}{Argument1:車;摩托車;汽車;}去買菜{VNPair:(Argument0,Argument1)}

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Figure 1. Frame content example.

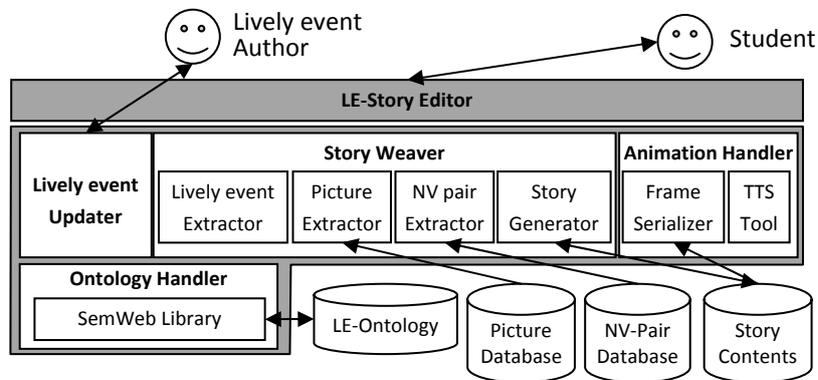


Figure 2. The storytelling system three-tier architecture.

1. System Architecture

Figure 2 shows the three-tier architecture of the LE-Story. The data tier consists of LE-Ontology, picture database, nv-pair database and story contents. LE-Ontology is used to fetch and store the information of the LE instances for inference. The LE is a key structure in storytelling with hierarchical properties, thus the use of ontology is a good aid in maintaining reasonable information and hierarchical data. The picture database is used to store the phrase-image pair information. It lets the system know the synonymous relationship between the picture and text. The nv-pair database provides information about the noun-verb relationship. It lets the system know the constraints of the event frames. The story contents are the stories which the students weaved. The system can generate the final animation from the story contents.

The presentation tier is the LE-Story editor which supports the LE author and student interface. For the LE author, suitable LEs can be added into the LE-Story. For students, the system provides selecting, editing and animating functions to weave a story from the LE-Ontology. Students can drag and drop the phrases into the correct frame element position. The intelligent system shows an image to assist students to recognize the phrase which they preferred. After finishing the editing, the system can deploy the contents in real time and show the resulting animation.

The logic tier is the intermediate part of the LE-Story editor. There are four components in the logic tier: the lively event updater, ontology handler, story weaver and animation handler. The lively event updater can insert, select and modify the LE which

could be extracted by the story weaver. Both the lively event updater and the story weaver use the ontology handler to access the LE-Ontology. The ontology handler is a semantic web component with the functionalities of ontology processing. The ontology handler can load the whole of the ontology to the runtime object or save the runtime object to the ontology.

2. LE-Ontology Design for the Storytelling System

In order to represent and maintain the stories in a hierarchical way, in this section, we will describe our LE-Ontology design, the course-related knowledge specifies in LE-Story, and its sub-elements. The design is shown in Figure 3. The root of the LE document is the *Project* node, which contains the LE information (*LivelyEvent*) and categories (*Category*). The *LivelyEvent* node contains the *Script* node and the *Script* node contains the *Frame* node. The LE, script and frame are used to construct the main skeleton of the LE structure. The *name* attribute is used to represent the name information. The *index* attribute is used to store the specific ordering of the resources. The *content* attribute is in the Frame node and provides the embedded frame content (Figure 1). The frame content indicates the replaceable frame elements such as the key phrases and the relationships of the event frames. We can use the lively event updater mentioned above to create and edit the LE.

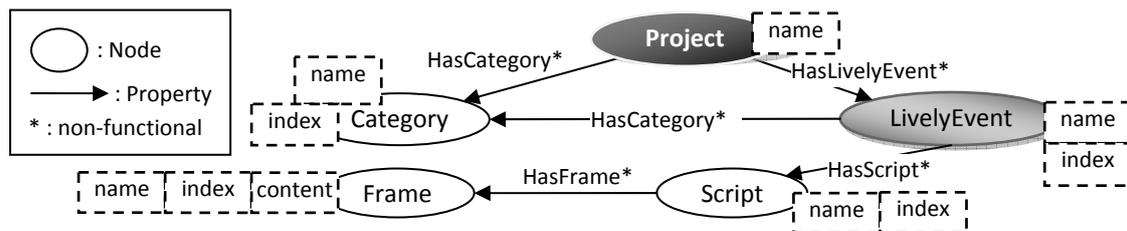


Figure 3. LE-Ontology design.

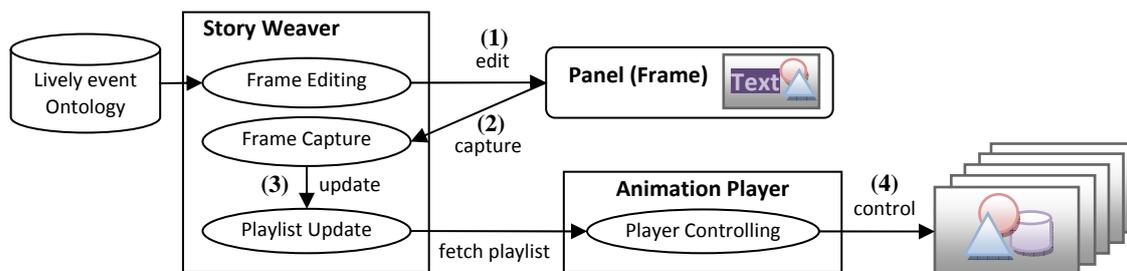


Figure 4. The process of story weaving using LE-Story.

3. LE-Story Demonstration

There are four steps to complete the storytelling task (Figure 4). In the *frame editing phase*, the text builder provides the functionality to help the student to customize their story frame. The student can choose one of the preferred sentence patterns and modify it by dragging and dropping the frame elements from the text builder. When the student chooses a sentence pattern, the system will show the images related to the sentence pattern. In the *frame capture phase*, the frame is captured as a frame object such that the system can store the object for reuse. The frame object is a data structure which contains the information that helps the system to carry out word segmentation, event frame recognition, and TTS generation. In the *playlist updating phase*, the captured frame is referenced into the playlist sequentially, and the actual frame is stored into the story contents. The student can decide which frames will

show up, how many frame pages there are and the playing order. In the *player controlling phase*, the students can control the animation player to repeat, pause or skip to the next frame. The player displays the images according to the playlist, and fetches the actual data from the story contents. The TTS is working and the system uses a colorful bar to mark the current reading line for better reading guide.



Figure 5. Using the LE-Story to edit the story frames.

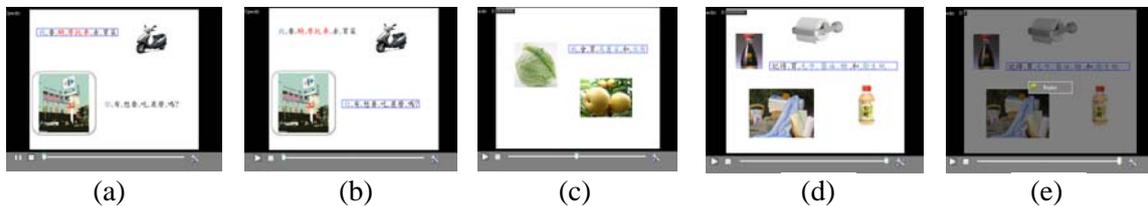


Figure 6. The final animation of the “Go grocery shopping” story.

3.1 Example: Foreign Spouses’ Chinese Class

In Taiwan, there are more and more new immigrants and many of them are spouses of foreign nationality. The foreign spouses are different from the ones who only live in Taiwan temporarily. They may live in Taiwan for a long period or permanently, and most of them have a responsibility to educate the next generation. So it is essential for such spouses of foreign nationality to learn Chinese well for lively conversations. However, most of the families into which they have married usually hope that these new members will only play a role as housewife. Therefore it is crucial to solve the problems of how to increase their learning confidence and how to get the support of the other members of the family. To solve these problems, we can use the LE-based storytelling system to let the spouses weave their lively stories. Through the use of the lively-story animation, they will be more easily able to share their learning achievement with their family, so that family members will give more support to their new member to take part in language learning classes. With the support of their family, these new immigrants will have a stronger motivation and more confidence to learn Chinese.

First of all, we need to design a LE for the storytelling material such that the students, spouses of foreign nationality, can create their stories using course-related content. In the countryside, the spouses of foreign nationality are almost all housewives and go grocery shopping daily. So in this example, we designed a LE of “Go Grocery Shopping”, and the story weaver can easily fetch the relevant LE information. All possible sentences generated from the user indicated frame content and displayed in the sentence list (Figure 5). The student begins the story of “我要騎摩托車去買菜” (“I’m going to ride my scooter to buy some vegetables”) and “你有想要吃甚麼嗎?” (“What do you feel like eating?”) in Figure 5(a). Then, the student states the ingredients she wants to buy: “我要買高麗菜和水梨” (“I want to buy some cabbages and some pears”)(Figure 5(b)). Finally, the student illustrates which

groceries she is considering buying: “記得買毛巾, 醬油, 醋和衛生紙” (“Remember to buy a towel, soy sauce, vinegar, and toilet paper”(Figure 5(c)).

Figure 6(a~e) is the final animation of the shopping story. The system creates the word segmentation, marks the colors, and displays the current reading bar. The student can use the player control panel below to control the animation with the play, stop, replay, and skip to the specific page functions.

4. Conclusions and Future Work

Storytelling is an effective way to increase student motivation in language learning. In this paper, we implement a storytelling system called LE-Story to let students practice their daily conversations. We use course-related LEs as resources for the students to tell their stories. We define a standard OWL format ontology for the LE structure. The system can use the LE information to help students to construct their stories using a friendly drag and drop method. We have used an example of a Chinese language class to demonstrate how the storytelling process carried out in LE-Story. We hope that the LE in this example can be extended to many other kinds of scenarios in the students' daily life, such as “Making a Phone Call” or “Doing Housework”. We would like to ask spouses of foreign nationality to use LE-Story so that we may try to analyze their behaviors in the process of storytelling. We can use the data to improve the storytelling procedure to make the LE-Story more friendly to use, such as by adding a more general smart text input assistant. Educators can also use the data to determine the student's level in language learning and to identify areas where more practices may need to be done.

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