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Architecture, Textual Context Description, and Quiz Generation Scheme for the Movie Based Context-Aware Learning System

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***Abstract*—The concept of the movie based context-aware language learning, which the authors presented in the previous work, is refined in this paper. This paper presents three tiered architecture of the movie based context-aware learning system to enable reuse of movie context description; textual context description which describes the object oriented context model in the text form to alleviate effort describing the movie context; and a template based quiz generation scheme that generates quizzes and their expected answers from the movie context description in a language independent manner.**

Keywords—context-aware learning; movie; language learning

I. INTRODUCTION

Implementation of the context-aware u-learning system, which facilitates contextual language learning, has been extensively investigated over the last decade. Researchers in the e-learning domain have presented some context-aware language learning applications such as PCULS [1], HELLO [2], TANGO [3] *etc.* These applications demonstrated that learning from real environment through the context-aware u-learning system is certainly more attractive for language learners. Providing language contexts enables the learner to have richer vocabularies as well as richer language expressions. The applications utilize mobile as well as ubiquitous technologies to acquire particular environment contexts to facilitate learning from real environment or through real experiences. However, it brings complexity to developer of the system as well as to the teacher who prepares the contextual learning content. The system requires configuration, deployment, and maintenance of physical devices such as RFID tags, markers, sensors, audio and visual devices *etc.* before learning. In addition, availability of real time network connection is another important issue. Such complexity increases barriers to adopt the system.

Recognizing advantages of using film to teach languages emphasized in [4], authors are motivated to develop a movie based context-aware language learning system as an alternative solution for contextual self-language learning to reduce complexity. In movie based context-aware language learning, learners learn languages through situations that occur in the movie. In other words, education is given with context-awareness in the imaginary context situated in the movie scene. Plentiful contexts in the movie can be utilized for language learning as same as real environment, as it is known that the movie can facilitate comprehension activities that perceived as real. Since events in the movie are foreseeable, we can describe contexts of the scenes in the movie in advance. The developer does not need special device to acquire the context as well as efforts to know unexpected circumstances in design of the context-aware learning system [5]. Through this approach, various learning situations can be presented with less effort than a context-aware u-learning system does. For instance, we can create a learning task to learn vocabularies and language expressions associated with jungle from a scene situated in the jungle instead of managing a learning task situated in a real jungle. These contribute to limit cost and effort to develop and operate the system.

This paper discusses implementation of a movie based context-aware quiz generation system as one of possible form of the movie based context-aware language learning system which facilitates teachers in creating contextual quizzes from movie electronically. Unlike current approach where teachers are required to prepare quizzes conventionally by watching the movie in advance and planning possible related quiz over and over, this proposed approach only required teachers to watch and compose description or annotation associated with the scene once as much as possible. The description composed must be consistent to the provided formal syntax [5]. Ability to empower the scene descriptions as a quiz source artifacts which allows various types of quiz generation by implementing various generation rules is the excellence of this approach.

II. MOVIE BASED CONTEXT-AWARE LEARNING SYSTEM

A. Concept of Movie Based Context-Aware Learning

The concept of movie based context-aware learning is to facilitate contextual learning through contextual situation replied in the movie scene. The context of the movie is described and embedded in the movie by the teacher in

advance. The scene description serves as artifacts to generate various types of learning tasks. In this paper, the authors focus in context-aware quizzing by implementing some rules to produce many kind of quizzes. Through this approach, learning can be any time and any place without depending on network connection.

Note that the movie context includes not only something which the learner can recognize directly from visual and audio of the movie but also something the viewer can know or deduce based on the story or implication of the movie.

B. *Three Tiered Architecture of the Movie Based Context-Aware Learning System*

The authors introduce a three tiered architecture to implement movie based context-aware language learning applications. The architecture consists of three layers: physical layer, context representation layer, and context-aware learning application layer as shown in Fig. 1.

The physical layer is responsible for replaying the movie and extracting the context description annotating the movie as ordered by context-aware learning applications. Physical time and space information of the movie is handled in this layer.

The context representation layer provides context representation shared by context-aware learning applications and functions handling the context representation. As the movie is replayed, the story goes and the movie context changes. Therefore, each description in the context description has physical life time and space in the movie. In other words, there exist temporal and spatial links from the context representation layer to the physical layer.

The context-aware learning application layer provides applications utilizing context-aware representation and giving various learning tasks for the learning.

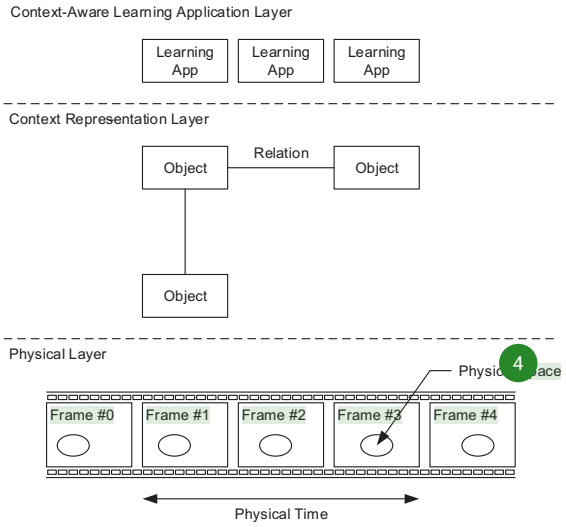

Fig. 1. Three tiered architecture of the movie based context-aware learning system

C. *Object-Oriented Context Model*

The movie context, which is provided in the context representation layer, should be formally described before context-aware learning applications utilize the context to give learning tasks to the learner. Its representation must be uniform, universal, and natural language independent so that the context descriptions written once can be reused by different learning application for different natural languages over and over. For this purpose, the authors employed the object-oriented modeling in [5] since the object-oriented approach is widely adopted to describe the problem domain uniformly in software development and expected its universality. Moreover, although it is described with a specific natural language, the concept of the object oriented model itself is language independent. Fig. 2

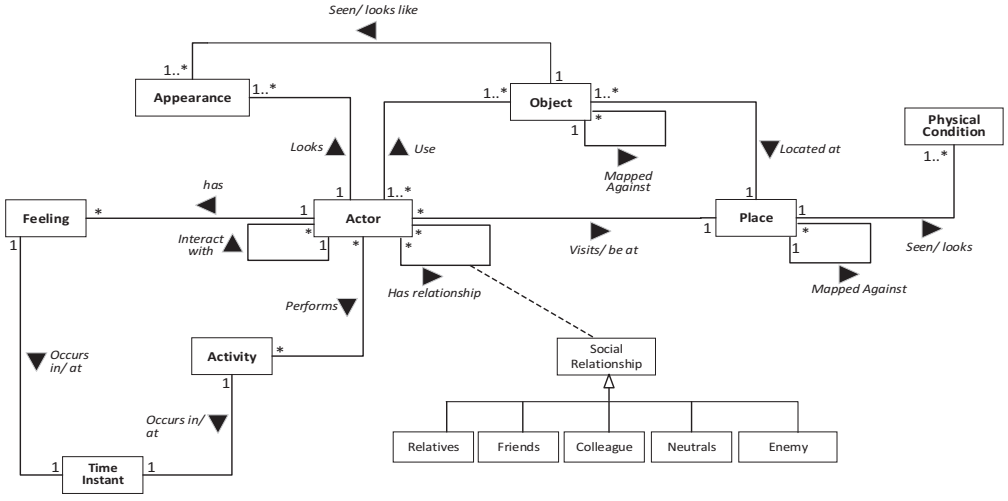

Fig. 2. Object-oriented context model

shows the current version of the object-oriented model for the movie context description.

III. Context Description Language

It is desirable to compose the movie context description automatically from the movie; however, thinking state-of-the-art image and phonetic recognition and understanding and artificial intelligence, only a limited class of composition is possible. Moreover, the movie sometimes includes contexts which are not represented explicitly. Therefore, it requires human work to compose the movie context.

In authors' framework, the movie context is described based on the object-oriented model shown in the class diagram of Fig. 2. It is possible to edit the object diagram subject to this class diagram; however, it is time consuming to compose object diagrams representing the context through the movie. The authors define textual formal language to describe the movie context on the object-oriented model easily and quickly.

The syntax of the textual formal language is shown as Backus-Naur Form in Fig. 3. The starting symbol of the language is *MovieContextDescription*.

MovieContextDescription
  = (*ObjectDescription* | *RelationDescription*)+.
ObjectDescription
  = "\" *ClassName* "{" *ObjectIdentifier* "}"
    "{" *PropertyList* "}".
ClassName
  = "Actor" | "Appearance" | "Feeling" | "Object"
  | "Activity" | "Place" | "PhysicalCondition"
  | "TimeInstant".
RelationDescription
  = "\" *RelationName* "{" *RelationIdentifier* "}"
    "{" *SourceObjectIdentifier* "}"
    "{" *SinkObjectIdentifier* "}"
    "{" *PropertyList* "}".
PropertyList
  = ε
  | *PropertyDefinition*
  | *PropertyList* "," *PropertyDefinition*.
PropertyDefinition
  = *PropertyName* "=" *PropertyValue*.
ObjectIdentifier = *Identifier*.
RelationIdentifier = *Identifier*.
SourceObjectIdentifier = *Identifier*.
SinkObjectIdentifier = *Identifier*.
PropertyName = *Identifier*.
Identifier = [A-Za-z0-9@.]+.

Fig. 3. Syntax of textual language for the object-oriented movie context description

Fig. 5 and 6 show the object diagram and its textual description in the above language to describe the movie context shown in Fig. 4, respectively.

Fig. 4. A snapshot of the example movie

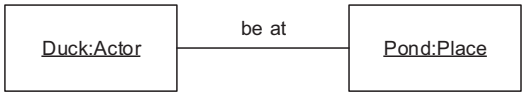

Fig. 5. Object diagram describing the movie context of Fig. 4

\Actor{Duck}{word.en="duck", word.id="bebek"}
\Place{Pond}{word.en="pond", word.id="kolam"}
\beAt{duckOnthePond}{Duck}{Pond}{}

Fig. 6. Textual description describing the movie context of Fig. 4

IV. Context-Aware Quiz Generation

A. Components of the Movie Based Context-Aware Learning Application

The movie based context-aware learning application consists of four principle components as shown in Fig. 7.

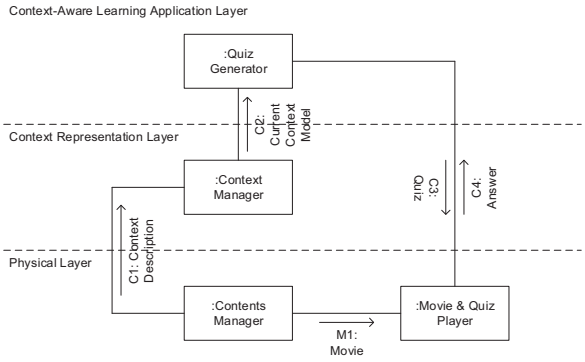

Fig. 7. Components of the movie based context-aware learning application and their interaction

- The contents manager gets the learning content consisting of the movie and its context description and provides them to the context manager and the movie & quiz player, respectively.
- The context manager maintains the context model based on the context description transferred from the contents manager. The context description is traceable from the

physical time of the movie. The context manager constructs or destructs objects and relations among objects of the context model when they get active or inactive.

- The quiz generator generates quizzes and their expected answers based on the current context model, which the context manager maintains.
- The movie & quiz player replays the movie transferred from the contents manger and shows the quizzes generated by and transferred from the quiz generator. The player prompts the leaner to answer the quiz with replaying the movie and sends the answer back to the quiz generator. Then, the quiz generator checks if the answer is the expected one.

B. Automatic Quiz Generation

Automatic quiz generation from the current context model is the keystone of the movie based context-aware language learning system. It should be allowed to construct multiple quiz generators which generates quizzes for different learning objectives and run them concurrently in the learning system.

Automatic quiz generation is template based. The quiz sentence and its expected answer are generated from the template prepared in advance. The generator parses the current context model, references properties of the objects in the context model, applies them to the template, and generates quizzes and their expected answers. Reference to the properties is embedded in the template possibly with modifier functions that changes the text.

Fig. 8 shows an example template which generates quizzes asking the learner what he/she can see at the specified place. The upper and the lower question and expected answer pairs are for English and Indonesian, respectively. <*Class#PropertyName*> means a reference to the property value of *PropertyName* defined in the *Class* instance of the object oriented context model. *beAt.Actor*(<*Place*>) gives the *Actor* instance which has a relation *beAt* with the *Place* instance in the object oriented context model. A modifier function *prependEnglishArticle*(*n*) gives the noun which is prepended an appropriate article to the noun *n*. Modifier functions are basically language dependent. An important role of the modifier function is to absorb difference among languages to keep the context model language independent.

```
Question:
   What is in prependEnglishArticle(<Place#word.en>)?
Expected Answer:
   prependEnglishArticle(beAt.Actor(<Place>)#word.en).
Question:
   Apa yang ada di <Place#word.id>?
Expected Answer:
   beAt.Actor(<Place>)#word.id.
```

Fig. 8. Example template for automatic quiz generation

For example, if we apply the template of Fig. 8 to the context description shown in Fig. 5 or 6, the quizzes and expected answers shown in Fig. 9 are generated.

```
Question:
   What is in the pond?
Expected Answer:
   A duck.
Question:
   Apa yang berada di kolam?
Expected Answer:
   Seekor Bebek.
```

Fig. 9. Generated quizzes and expected answers

V. CONCLUSION

The authors proposed the concept of the movie based context-aware learning in [5]. In this paper, the authors have refined its concept; in more detail, the authors have presented the three tiered architecture of the movie based context-aware learning system, textual context description alleviating effort needed for context description, and a template based scheme for automatic quiz generation enabling reuse of the context description for different languages. Future work is to refine the object oriented context model for more expressive power of the movie context possibly with introducing the case grammar concept which is well-known in the field of natural language processing.

ACKNOWLEDGMENT

This work is financially supported by Directorate of Higher Education (DGHE) of Indonesian Government.

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