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DESIGN OF A JAVANESE INTELLIGENT TUTOR: AN ALTERNATIVE TO PRESERVE ENDANGERED LANGUAGES

ABSTRACT *Language is a means of communication in writing and in speech, is important part of culture of every nation, and helps to maintain the history and civilization. The domination of languages such as English reduces the significance of local languages and makes them marginalised. Many research projects address endangered languages, in the attempted vitalisation methods and development of their effective teaching methods. The article discusses Intelligent Tutoring System as applied to Artificial Javanese Intelligent Tutor (AJI-Tutor).*

Key words: *Intelligent Tutoring Systems, Javanese language*

1. INTRODUCTION

Most people in the past learnt their first language naturally from observing of and listening to surrounding environments such as parents and relatives,

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without any concerns for grammar rules. However, the language learning today is far from its natural way and is dominated in many countries by English as second or foreign language.

One of the possibilities to attempt to preserve the language from becoming extinct is research in the area of Javanese language learning using Intelligent Tutoring Systems (ITS).

2. INTELLIGENT TUTORING SYSTEM

The field of artificial intelligence with links to education was established in 1970s (Zhang, 2005). One of its applications are intelligent tutoring systems. ITS is an expert system (Zhang, 2005) which provides individualised tutoring (Maciejewski, 1994) or web based instruction for students and is based on intelligent agents (Rosić, 2006). Such a system can recognize the student characteristics like knowledge, behaviour, and even emotions. For developing an ITS its four modules need to be developed (Rosić, 2006; Joshi, 2009; Maciejewski, 1994).

The first module is the domain of the expert module. The content of this module contains sets of facts and rules, the curriculum, the objectives of teaching and all of the material that must be presented to the student. Another function of this module is evaluating the student's performance.

Student module is the second. Students are referred to as learners of the curriculum or users of the ITS. The ITS applied to the student will provide some diagnostic tests for acquiring the student characteristics according to the answers to these tests. The module needs to be capable of modelling the student. This modelling constitutes the basis for an adaptive feedback given to the student and for a decision about the next lesson for the student.

Pedagogical module refers to the teacher or instructor who teaches the student. This module also represents the instructor's strategies for teaching, guiding or tutoring the student. These strategies determine when and how to instruct the student. There are many ways for instruction that depend on the instruction modes and strategies of the instructor. For example, the instruction may be directly pointing to the student's error and giving the correct answer to him/her, or indirectly providing suggestions helping the student to find out the correct answer.

The last module is the interface which has the role as a communication bridge between the ITS and the student/learner. The interface becomes a very

important part of an ITS since all the communication and interaction with the system takes place here. The course material is presented to the student and the student inputs are received through this module. The interface must be well designed to keep the student's attention at a high level. It must be easy to use and as attractive as possible so that the interaction with the system will not be boring. The interface can be composed of many graphical elements like buttons, menus, text, animations and multimedia. Virtual reality will make the system more attractive. An interface usually has the capability of Natural Language Processing (NLP) to facilitate the natural communication between ITS and the student (Schoelles, 1997; Zhang, 2005).

The consolidated system of the four modules teaches the students by giving them some problems to solve. The system knows the solution of the problem given to the student. It compares the solution from the student with its own solutions which it takes to be the right answer. After that, the system diagnoses the student based on the differences between the two solutions. This is followed by giving the student a feedback. The feedback will determine the next process of the tutorial.

3. INTELLIGENT LANGUAGE TUTORING SYSTEM (ILTS)

The difference between Intelligent Language Tutoring Systems (ILTS) and general ITS is only linguistics as learning objects in the domain of the expert module. The materials should consist of grammars and lexicons of languages (Maciejewski, 1994). Researches and innovations in ILTS were conducted by scientist in many languages such as English, Japanese, Chinese and Indian.

Nihongo Tutorial System is a specific ITS to improve Japanese reading proficiency of scientists and engineers who speak English (Maciejewski, 1994). Parse Tree Editor is used to produce the knowledge database which contain syntax, semantics, phonetics and morphologies of the Japanese language. By using graphical user interface, students can obtain information and examples from the system. The interaction between student and the system will update information in the student module which is used by tutoring module to select instructional approach based on students' language proficiency, technical area of interest and available tutorial in knowledge database. Nihongo Tutorial System uses overlay modules – a common student module which considers students' knowledge in the context of experts' knowledge. However, the overlay approach only manages the students' error which comes from partial comprehension.

There are many examples of English as material in ILTS. FLUENT is designed to promote implicit language learning using Natural Language Processing with animation as medium of conversation (Schoelles, 1997). Another example is Hyper English, contextual software for assisting the students with various stages of language competency to achieve specific level based on their needs (Plantamura, 2005).

Intelligent Chinese-Teaching Systems was developed by Chen Xiaogang & Chen Zengwu (Zhang, 2005). The systems architecture consists of Chinese grammar database, reasoning machine which can understand natural expression, interactive learning environment and a student module with certain grammar analysis. Student use the system to analyse, evaluate and correct their Chinese language homework.

Application of ITS in language domain must deal with some challenges such as knowledge representation, language learning instructions, response analysis and appropriate intervention when mistakes are made by students (Joshi, 2009). Constructivism theory in language domain can trigger students' critical thinking through constructing linguistic knowledge from observation and interpretation that is guided by the instructor in the constructivist environment. Integrating Computer Aided Language Learning (CALL), Constructivist Learning Environment (CLE) and Intelligent Tutoring System (ITS) applied in Intelligent Environment for Learning Indian Languages (IELIL) aim to help students in Marathi language construction. Sentence structure complexity can be improved by discussion with the language experts.

4. THE DESIGN OF ARTIFICIAL JAVANESE INTELLIGENT TUTOR (AJI-TUTOR)

Javanese is one of the traditional languages in Indonesia and is a native language of more than 75,500,000 people (Wedhawati, 2006). However, most of them can not use the language properly. Recent research on Javanese language proficiency of students found that the Javanese youngsters can not apply correct *Krama* vocabularies in formal dialog based on context since the language is rarely use at home and in social organizations (Subroto, 2008).

AJI-Tutor is designed for assisting learners who want to learn Javanese language at a correct level of politeness. This system will use typical architecture of ITS which consists of student, teacher, expert and communication modules.

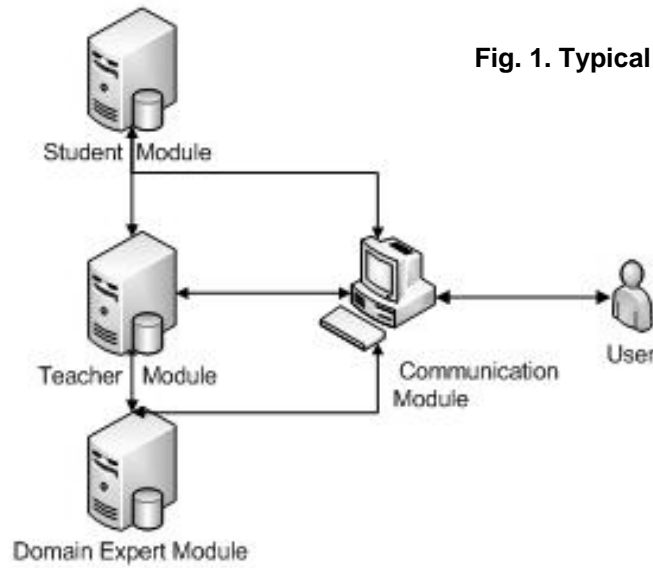


Fig. 1. Typical architecture of ITS

4.1. Domain Expert Module

To create the provision of the knowledge for the system, domain knowledge in AJI-Tutor should cover levels of politeness with its vocabularies, grammars, and story lines for contextual learning. The design of domain knowledge is represented by the Class Diagram in Figure 2. The asterisks (*) symbol in Figure 2, Figure 3 and Figure 4 show many relationships between classes (users, actions or other objects), for example numerous experts can create many domain knowledge sets.

The levels of language politeness were initiated in the Java Island around seventeenth century when Mataram, the biggest kingdom, was ruled by the Sultan Agung (Wedhawati, 2006; Subroto, 2008). These levels have specific vocabularies which are stored in the Javanese language dictionary, classified by the difference of age and social status of Javanese speakers and people who are spoken to. The *Ngoko* is informal speech, used between friends and close relatives, *Madya* is the intermediate level and *Krama* is the polite and formal style. Javanese people will typically assume that someone who speaks without a proper level of politeness is a rude person.

TABLE 1
Examples of *Ngoko*, *Madya*, *Krama* vocabularies

Ngoko	Madya	Krama	English meaning
aku	kula	dalem	I (the 1 st person)
duwe	gadhah	kagungan	have
aran, jeneng	nama	asma	name

Javanese language uses SVO (Subject, Verb, Object) as its basic structure. For example “aku (S) numpak (V) sepeda (O)” or “kula (S), nitih (V) sepeda (O)” means “I ride a bike” in *Ngoko* and *Krama*, respectively. There are possible combinations using preposition (prep), adjective (adj) and adverb (adv) to produce more complex sentence such as “aku (S) numpak (V) sepeda (O) anyar (adj) menyang (prep) pasar (place)” or “kula (S) nitih (V) sepeda (O) enggal (adj) dateng (prep) peken (place)” for saying “ I ride a new bike to the market”. Again in *Ngoko* and *Krama*, respectively.

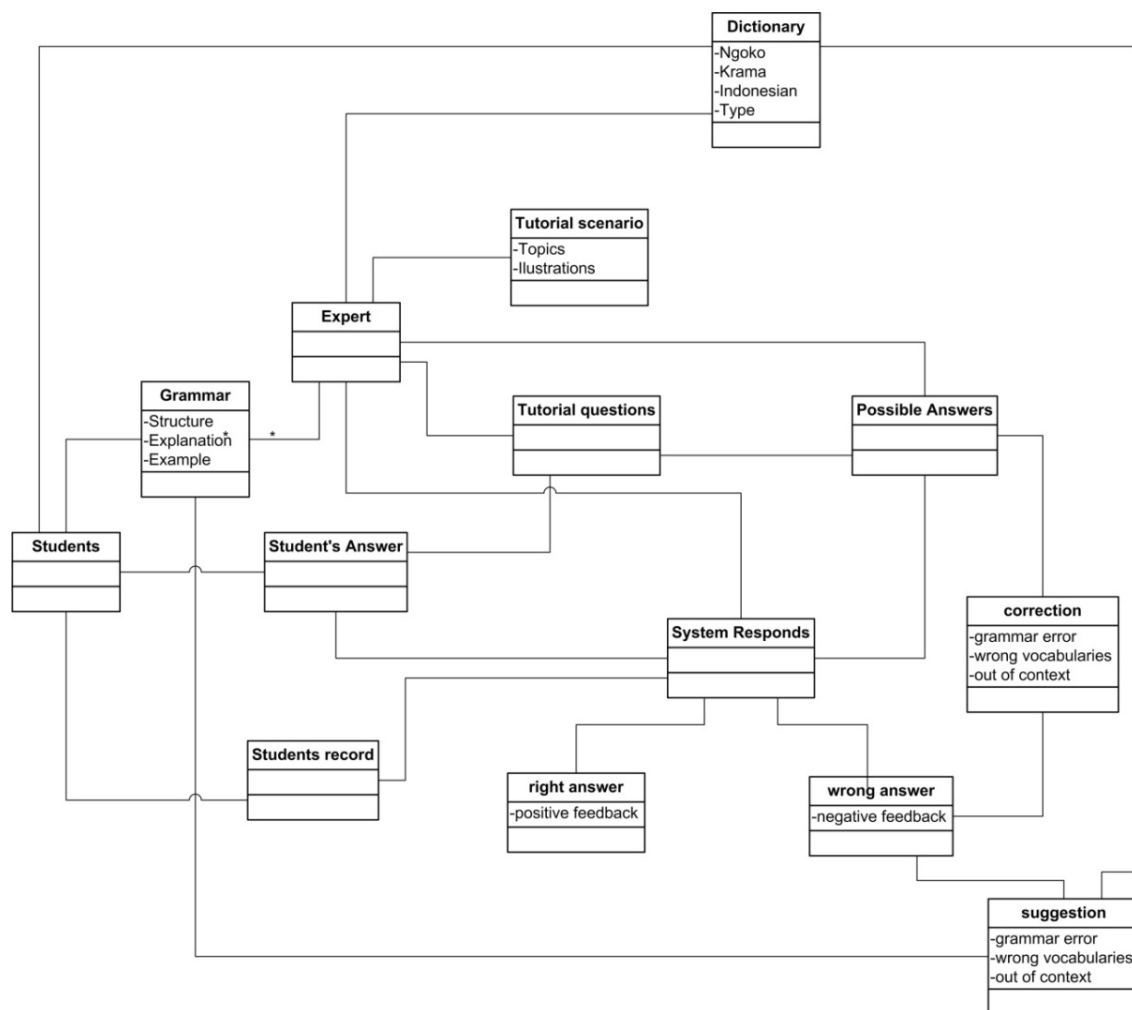


Fig. 2. Class Diagram of AJI-Tutor

The last part of this module is a story line for contextual learning which is titled “*dolan menyang omahe simbah*”. The scenario occurs when the student visit his/her grandfather who lives in the village. In this system, the student will have conversation with his/her grandfather about daily life activities such

as shopping in the market, answering telephone and raising the cattle. The students are motivated to use *Krama* to speak with their grandfather. If they use the language improperly, their grandpa will tell them the truth. Therefore, the scenario should contain various rules which can respond the student's actions.

The main actors who can create and modify domain knowledge are experts or language teachers. They can make modifications to grammar rules, dictionaries, topics of learning and tutorial rules (questions and answers). Figure 3 shows various actions of experts which are represented by Use Case Diagram.

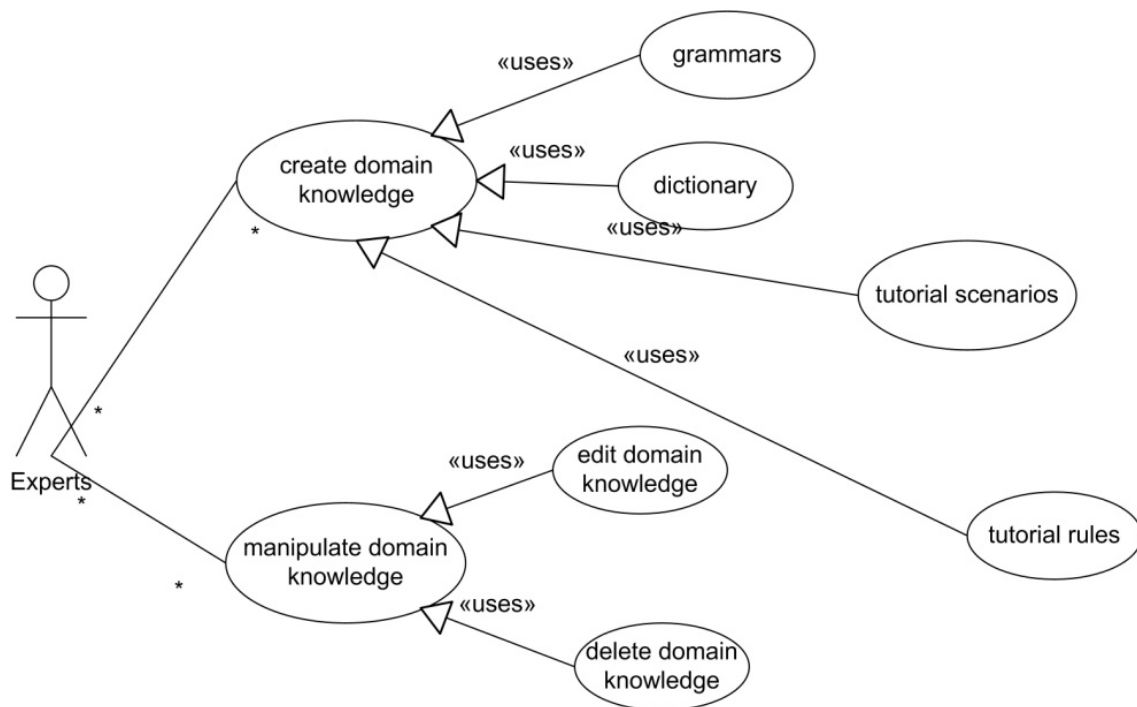


Fig. 3. Use Case Diagram of expert for AJI-Tutor

4.2. Student Module

Students can choose tutorial materials from the domain expert module and they will get questions based on the selected topic. Grammar explanations and dictionaries are provided to help students who have difficulties during tutorials.

Student module of AJI-Tutor should respond to the student adaptively. Students will get positive response if they answer the question correctly. If they were wrong, the system will give suggestion and correction or negative response

if they use incorrect level of politeness. The Use Case Diagram in Figure 4 shows a variety of students' actions in the student module.

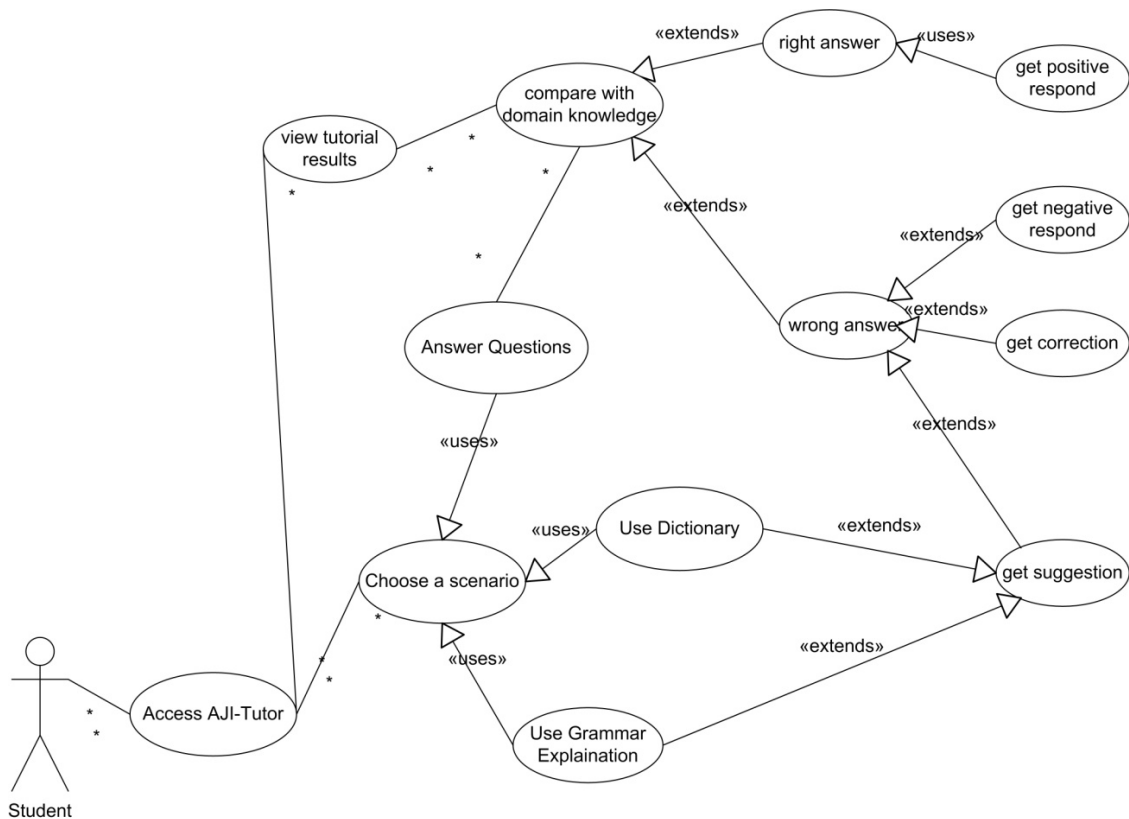


Fig. 4. Use Case diagram of student for AJI-Tutor

4.3. Teacher Module

The teacher module combines contextual learning and constructivism methods for Javanese language learning. The context is usually neglected by traditional language learning since the conventional approach focuses more on the structure and terminology of the languages (Plantamura, 2005). There is a possibility that students learning activities will be simulated by their experience of using the language in a social context dialogue. In a direct approach, one possible strategy to recognize and create meaningful contextual language in ILTS, computational forms of linguistic knowledge such as lexicon and grammar are stored in the domain expert module (Schoelles, 1997). The contextual learning using daily activities simulation can increase students' motivation. On the other hand, the constructivist approach is focussed on personal experience of students when they investigate and observe the knowledge through the learning environment

(Joshi, 2009). Combination of the constructivism theory may create a better teaching module which can guide students to construct knowledge based system on their experience in daily life activities.

4.4. Communication Module

Natural communication between the system and its users should be generated to learn language implicitly and naturally (Schoelles, 1997). Natural Language interface can produce more convenient interaction between human and computer (Zhang, 2005). According to Greasser, Lu et al (2004), Natural Language dialog will be effective if implemented in a system which requires an accurate answer for the dialogue such as a qualitative and verbal tutoring environment. Moreover, the system's effectiveness will improve if the users of the system have a low or medium level of knowledge. Tutor dialogue actions can be feedbacks, prompts, hints and summaries (Greasser, 2004).

This conversation below shows the design of conversational features of AJI-Tutor. The Javanese conversations use italic fonts, the explanations are in brackets and capitals are for system's actions and normal font is used for English translation, as showed by the example:

AJI-Tutor :*"Kowe ngerti, kae kewan apa?"* (MAIN QUESTION: Did you know, what is that animal?)
Student :*"Ora ngerti"* (I don't know) ANSWER IN NGOKO.
AJI-Tutor :*"Kok ora nganggo basa krama!* (NEGATIVE FEEDBACK: Why you didn't use *Krama!*)
Coba dibaleni nganggo basa krama.. (HINT: please say it again using *Krama*)
Student :*"Kula mboten mangertos"* (I don't know)
AJI-Tutor :*"Bocah pinter!"* (POSITIVE RESPONSE: smart boy!), *Kewan kae sapi* (SUMMARISE: That animal is a cow).

Figure 5 presents the design of the Graphical User Interface (GUI) of AJI-Tutor. The design should be simple, user friendly and attractive because the users of the system are primary and secondary school students. The students can type their answer or respond in the dialog form then press enter to get a response from the system. The records of dialog between student and tutor

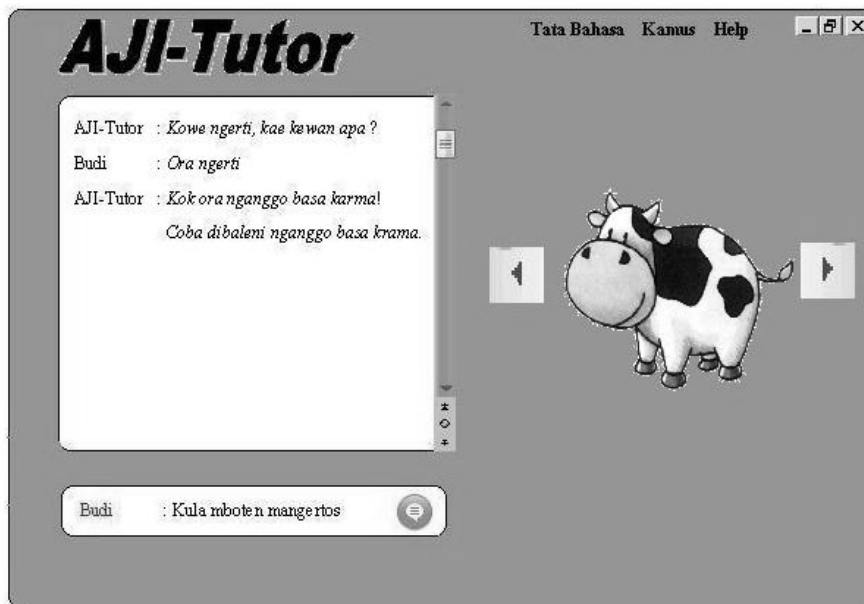


Fig. 5. Design of GUI for AJI-Tutor

are displayed in the dialog box. Students can read their previous dialog with the computer by using scroll bar. The picture or illustration may help students to focus on the tutorial topic which is can be changed by pressing the arrow buttons in the left and right of the picture. There are toolbars such as tata bahasa (grammars), kamus (dictionaries) and help (user's guide) which can help students to deal with any difficulties when they operate the programs. The dialog language between student and AJI-Tutor is Javanese, the user's guide is in the Bahasa Indonesia since most of users know Indonesian language better than Javanese language.

5. CONCLUSIONS

The goal of creating AJI-Tutor is to help in preserving the Javanese language, one of the traditional languages in Indonesia. AJI-Tutor adopts the architecture of Intelligent Tutoring Systems (ITS), which consists of domain knowledge, student, teaching and communication modules. Because of the complexity of system, a design based on object oriented approach has been adopted. The system is interactive and easy to use since the targeted users are students of primary or secondary schools.

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PROJEKT INTELIGENTNEGO TŁUMACZA JĘZYKA JAWAJSKIEGO JAKO ALTERNATYWA DLA ZACHOWANIA ZAGROŻONYCH JĘZYKÓW

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STRESZCZENIE

Język jest środkiem komunikacji w piśmie i w mowie. Jest ważną częścią kultury każdego narodu, służy zachowaniu historii i cywilizacji. Dominacja języków takich jak angielski zmniejsza znaczenie lokalnych języków i przyczynia się do ich marginalizacji. Wiele projektów badawczych adresuje zagrożone języki, w próbie ożywienia metod ich witalizacji i rozwoju metod ich nauczania. Artykuł omawia Intelligent Tutoring Systems w zastosowaniu do Artificial Javanese Intelligent Tutor (AJI Tutor).



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