International Journal of Engineering and Information Systems (IJEAIS)
ISSN: 2643-640X
Vol. 5 Issue 9, September - 2021, Pages: 15-25

Towards an Interactive Web-Based Tutoring System(IWTS) To Retain The Students' Motivation

Nehad T. A. Ramaha

Dept. of Computer Engineering, Karabuk University, Demir Celik Campus,
78050 Karabuk/Turkey
nehadramaha@karabuk.edu.tr

Abstract*— Recently, due to COVID-19 pandemic, the educational process in most educational institutions has transformed to e-learning. Thus, there has been an increasing amount of research interest in both synchronous and asynchronous e-learning. Although from an economical perspective, asynchronous e-learning seems to be the best option for educational institutions, retain students' motivated for the entire learning process still one of the biggest. Being one of the most used methods for the asynchronous e-learning, there is a need to find the best architecture for the Web-Based Tutoring System (WBTS) to be able to retain the students' motivation. Therefore, this study investigates the needed architecture for the Interactive Web-Based Tutoring System (IWTS) to retain the students' motivation, as WBTS should interact with the students in order to retain their motivation. Firstly, we reviewed the related work from the fields of assessing motivation in e-learning, interactive e-learning, and intelligent tutoring systems to find the most appropriate components for the IWTS system. Thereafter, we constructed our suggested architecture for IWTS. We also provided a full description for the components of the architecture and the relation between them to guide the development of any WBTS system to be able to retain the students' motivation.*

Keywords—Interactive Tutoring System; E-learning; Motivation; Web-Based Tutoring System; Retain students' motivation; ITS Architecture

1. INTRODUCTION

Recently, the role of technology in education has grown and many changes have happened to the learning environment. The delivery of the education in the e-learning environments can be done within two methods. The first method is the asynchronous e-learning. Using this method, the students can acquire the education in their own pace; receive the education at any time and in any place. Examples of the asynchronous e-learning environments such as educational websites, forum, and email. The second method for delivering education is the synchronous e-learning. This method allows the teacher and the students to communicate simultaneously. There are many examples of the synchronous e-learning environments such as video conferences and real-time web chats. (Hrastinski, 2008).

During the last two years, as a consequence of COVID-19 pandemic, many educational institutions around the world start to depend mainly on online education. Therefore, e-learning received more focus from the researchers. However, students and teachers generally have a bad impression about online education (Bruscato and Baptista, 2021a). Nonetheless, it's seems that the online education is the safest option during this pandemic (Bruscato and Baptista, 2021b). According to Ebner and his colleagues (2020), before COVID-19, online educational systems have often been used to support the traditional education, especially the learning management systems (LMS) websites that use the asynchronous e-learning method.

Although, both synchronous and asynchronous e-learning systems seem to have the same effectiveness in students' achievement, each system has different requirements (Bruscato and Baptista, 2021b). Synchronous e-learning involves simultaneous connection between the teacher and a group of students and for the best interaction in this type, each group should have a small number of students. For asynchronous e-learning, teachers have to initially prepare and design the course contents and tasks, they can also track the students' achievement and communicate with them using instructional websites, email, and/or forums. Although synchronous e-learning systems involve simultaneous contact between students and teachers that is more similar to face-to-face interaction, asynchronous e-learning systems considered best option for institutions from an economic perspective.

According to a large number of studies, students' motivation plays an important role in the success of the learning process and it's one of the key elements of education (e.g., Weiner,1985 ; Ames, 1992; Anderman and Maehr, 1994; Lin, Wu, and Wang, 2010; Ramaha, Basha, Ismail, Umer, 2015). As mentioned by Hrastinski (2008), students feel more motivated using the synchronous e-learning systems than asynchronous e-learning systems, as by using synchronous e-learning systems teachers interact directly with their students same as traditional classes. Therefore, one of the important issues in asynchronous e-learning is how to retain the students' motivation for the entire learning process, as students' usually feel isolated and interactivity level often considered trivial in the learning process (Keller and Suzuki, 2004; Hartnett, 2016).

As mentioned by Ramaha and Ismail (2012), for long time educators used the instructional design and educational activities to motivate the students in the e-learning systems. Although, the good instructional design is one of the important factors for students' motivation in the e-learning systems, retain students' motivations for the entire learning process yet one of the main challenges (Kew et al., 2018). Therefore, there are more researches that focus on the way to retain the learners' motivation during the asynchronous e-learning environments. Most of those researches focus on finding some motivational tactics to maintain students' motivation within the asynchronous e-learning environments (e.g. del Soldato and du Boulay, 1995; Astleitner and Leutner, 2000; Song and Keller, 2001; Arroyo et al., 2014; Hull and du Boulay, 2015). Although, finding motivational tactics are an important step, finding a well defined architecture for interactive web-based tutoring systems (IWTS) with the ability to retain the students' motivation is a critical step. However, there is a lack of researches that focus on finding this type of the architecture. Thus, this research tries to form a well defined architecture for an interactive web-based tutoring system with the ability to retain the students' motivation during the learning process.

2. RELATED WORK

Motivation has always been one of the major factors for students' achievement (Lin, Wu, and Wang, 2010), students with high motivation, involve better in the learning activities and are more likely to complete the tasks (Miltiadou and Savenye, 2003). Experienced teachers usually monitor student‘s motivation and interact with them to retain their motivation (De Vicente, 2003; Cocea, 2006; Derbali, Chalfoun, and Frasson, 2011a). According to Ramaha (2017), to retain learners' motivation for the whole learning process, the e-learning systems need to do two jobs; firstly assessing students' motivational state during the learning process, and then interacting with them to retain their motivation. Therefore, the following sections will present the related work in the context of students' motivation assessment, interactive e-learning, and intelligent tutoring systems. This will help us to find the needed components of the architecture of the interactive web-based tutoring system that have the ability to retain the motivation of the students.

2.1 Assessing motivation in e-learning

Assessing the students' motivation is crucial for developing an interactive web-based e-learning system. Most of the researches tried to assess the students' motivation from cues that could be easily addressed by the e-learning systems. We can classify those researches into three main types:

(1) First type used questionnaires and self-reports to assess the students' motivation:

In their study, Takemura, Nagumo, Huang, and Tsukamoto (2008) proposed an educational system with questionnaire facility to detect the students' motivation during the learning process, this system can be used by teachers to assess the students' motivation. Their study results showed that students' motivation increased using this way of assessing motivation. The self-report approach was used by de Vicente and Pain (1999a, 1999b) to assess the students' motivational state during the interaction with the system. Figure 1 shows their self-report approach which have six sliders that can be changed by the students to express their motivational state. The accuracy of assessing the students' motivation is high when we use questionnaires, as questionnaires are answered directly by the students (Zhang, Cheng, He, & Huang, 2003). Nonetheless, students' motivation changing dynamically over the time, this mean that students have to answer the questionnaires frequently. But, answering questionnaires frequently will disturb the learning process and considered a big burden for the students. Therefore, it's not a good idea to include IWTS a component for questionnaires and self-reports.

(2) Second type used additional equipments to assess the students' motivation:

Recently, more studies have started to use additional equipments to assess the students' motivation. Derbali and his colleagues (2011a; 2011b) used some physiological sensors such as brain waves EEG, skin conductance and heart rate to assess the students' motivation. Wang and his colleagues (2006) did another study that used sensors to monitor students' motivation. In their study, they used eye tracking system to monitor students' attention and interests. Some recent studies such as Qu and Johnson (2005) and Veliyath et al. (2019) also used eye tracking system to assess the students' motivation or some other motivational factors. Although, using physiological sensors seems to be an interesting approach, it is difficult to use them widely by educational institutes. As this type of equipments need a specialist to use them, the sensors also could affect the students' performance, and the sensors are expensive and economically inefficient to be used with a large number of students. Therefore, also we will not include IWTS a component for sensors.

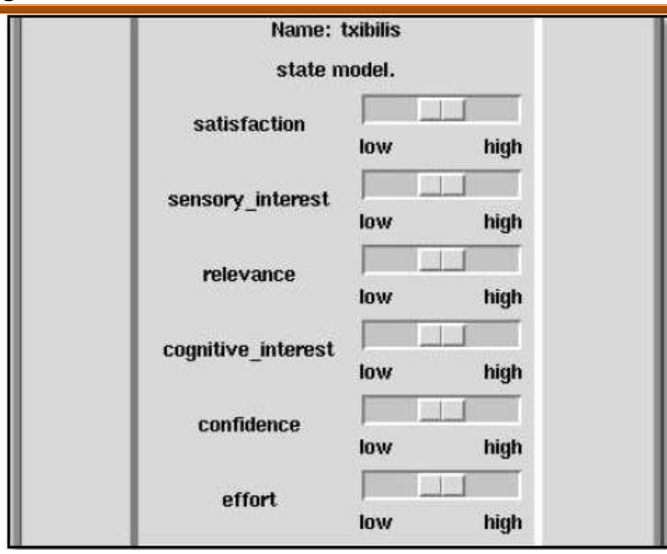

Fig.1 *Self-report in "MOODS" system (de Vicente & Pain, 1999a)*

(3) Second type used additional equipments to assess the students' motivation:

Interaction between the students' and the e-learning system produce various forms of data, such as mouse movements, time, asking for help, answer questions, perform the tasks, and many other performed actions, the modern systems usually save this type of data in a log file (Ghergulescu & Muntean, 2010). Many research, such as Beck (2004), Cocea & Weibelzahl (2009, 2011), Hershkovitz & Nachmias (2008), Kim, Cha, Cho, Yoon, & Lee (2007), Qu & Johnson (2005) and Zhang, et al. (2003), used time variables such as the time from start the system until the student start performing a task, the time spent reading the page, and the time spent on executing the task. Although, time variables could be used as an indicator of many motivational states such as effort, confidence, and attention, it is not always accurate. For example, Zhang and his colleagues (2003) used time variables such as the time to perform the task to assess the student confidence. They mentioned that if the student started the task quickly, this means that he/she had the certainty of success, and then his confidence level was high.

Another interaction data that could be used in this context is the mouse movement data. For example, in his study, de Vicente (2003) suggested to use data generated from the mouse movement to assess students' motivational state such as "Mouse movement not at random" is an indicator of "High attention". Many other performed actions analyzed and used by studies as indicators for students' motivational state. Examples of these actions are: the number of attempts to perform the task (del Soldato ,1994), frequency of requesting help (del Soldato, 1994; Qu & Johnson, 2005; Kim, et al., 2007), giving up the task (de Vicente, 2003), student performance in the quiz (Zhang, et al., 2003), the number of completed successfully tasks (Qu & Johnson, 2005), and the number of pages read (Cocea & Weibelzahl, 2009; 2011).

Using students' interaction data with the e-learning system seems to be one of the best approach that can be applied easily in any web-based tutoring system. Therefore, we will include the architecture of IWTS components for collecting data generated from student interaction, for storing the collected data, for analyzing the collected data, and for responding to the student's motivational state.

2.2 Interactive e-learning

As explained previously, it is believed that developing a well defined architecture to have components that give the system the ability to retain students' motivation is crucial for IWTS systems. As, IWTS systems consider as asynchronous e-learning systems that don't have direct interaction between teachers and students. Therefore, as mentioned at the beginning of this section after assessing students' motivation, IWTS should interact with them to retain their motivation. Hence, this part of the section reviews the works related to finding an architecture for e-learning system. Thereafter, we will try to find the best components that can be suitable for IWTS job.

Although, there is a lack of research works that suggested an architecture for interactive e-learning systems, we found some interesting research attempts. In their research Elgamal, Abas, and Baladoh (2013) presented an interactive web-based learning system for web programming. Their system has an online editor for writing, editing, updating, and executing programming code. This allows the students to execute examples and exercises online. Figure 2 represents the system architecture that suggested by Elgamal and his colleagues, the architecture is based on the general architecture of web-based applications which consist of three tiers: presentation tier, logic tier, and data tier. Elgamal et al. have built a dedicated architecture to their system. However, their architecture depends on the common used three-tier architecture. The three-tier architecture could be used also in IWTS as any interactive system have the client side interfaces, the application server, and the database server.

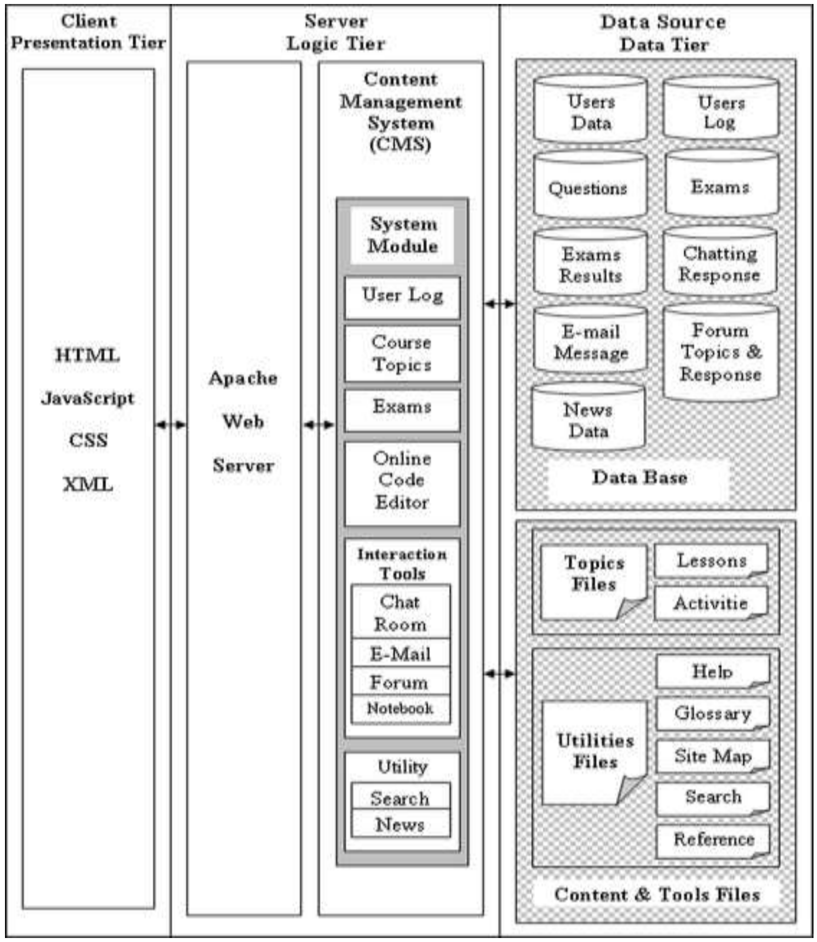

Fig.2 *System architecture of Elgamal et al (2013).*

Talib and Alomary (2018) proposed an architecture for an interactive distance education and e-Learning system based on Multi Agent System (MAS). The system that they proposed was for managing, scheduling, distributing and marking distance e-learning exams. The proposed MAS architecture that is shown in Figure 3 also have three tiers: agents' architecture, university data system, and faculty members. The agents' architecture consists of six agents, one agent for the student interface (SIA), and the other 5 agents SCEA, EDLA, ESA, EMSA, and EMA. The 5 agents are for exam scheduling, distribution, submission, managing submission, and making. The MAS architecture depends on the idea of dividing the system into multi agents, or in another term into multi module, and all those modules except SIA have a connection to the database. Although, MAS architecture not well defined and not clear enough, IWTS will use the idea of dividing the system into multi module. Moreover, IWTS should represent clearly the relationship between the modules and how they will communicate.

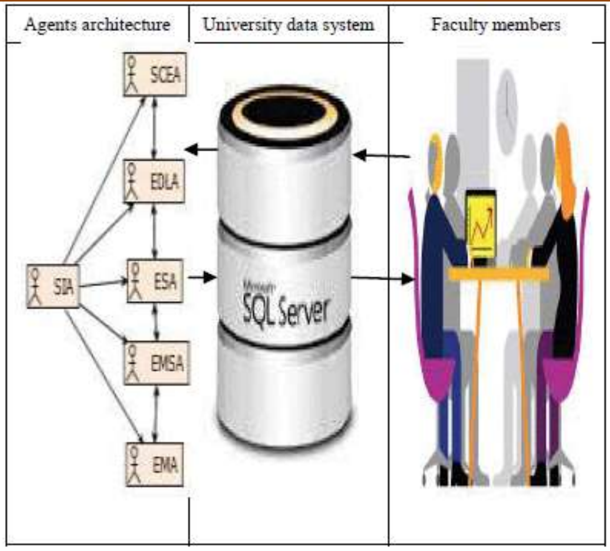

Fig.3 *Proposed MAS architecture by Talib and Alomary (2018).*

Another Interactive Multi-Agent Based Learning System (I-MBLS) proposed by Bokhari and Ahmad (2013) that have been designed for distance learning on the web. As shown in Figure 4, I-MBLS have 4 levels: Human level, web level, system level, and storage level. Actually, the human level not part of the system, thus I-MBLS suggested architecture is also a three-tier; the web level is the interface with user, system level is the server application tier, and the storage level is the database server tier. Moreover, the system level has six different agents, these agents collaborate with each other to make the interactive e-learning environment. I-MBLS is another multi agent architecture that uses the idea of dividing the system into three-tiers and also have multi agents (module) that interact with each other.

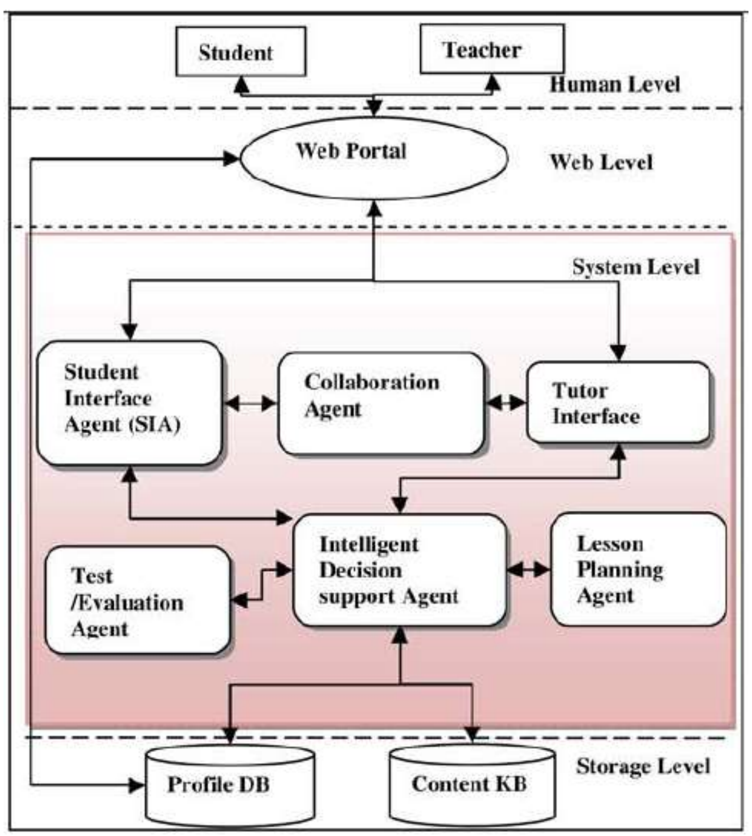

Fig.4 *Proposed i-MBLS architecture by Bokhari and Ahmad (2013).*

Many other research from the field of interactive e-learning also suggested three-tier architecture (e.g Masud and Huang, 2012; Alseelawi et al., 2020; Hendradi et al., 2020; Ramaha and Karas, 2021). Moreover, most of those researches present the system as a set of modules (agents). Therefore, the architecture of IWTS will use three-tiers: client side, application server, and database server. Also, the application server will have multi modules; later in this paper, we will discuss them in details.

2.3 Intelligent tutoring systems

In the last decades, many e-learning systems were developed to support the face-to-face learning process. Traditional e-learning systems present pedagogical materials sequentially (Butz, Hua, & Maguire, 2004). But, different students have different abilities and needs. However, traditional e-learning systems were not supporting the diversity of students knowledge and needs. Recently, more adaptable and flexible systems such as intelligent tutoring systems (ITS) emerged to support the learning process (Methaneethorn, 2008). Using the artificial intelligence (AI) techniques, ITS tutoring the students in a more adaptive manner. ITS systems designed to make explicit use of knowledge about teaching and learning in order to present a flexible and personalized educational materials depending on the characteristics of the student (Brusilovsky, 1999; de Vicente, 2003; Johnson, 2001). As shown in Figure 5, in order to provide adaptable education to students, typical ITS systems composed of four types of knowledge models: Domain model, Student model, Tutoring model, and Interface model.

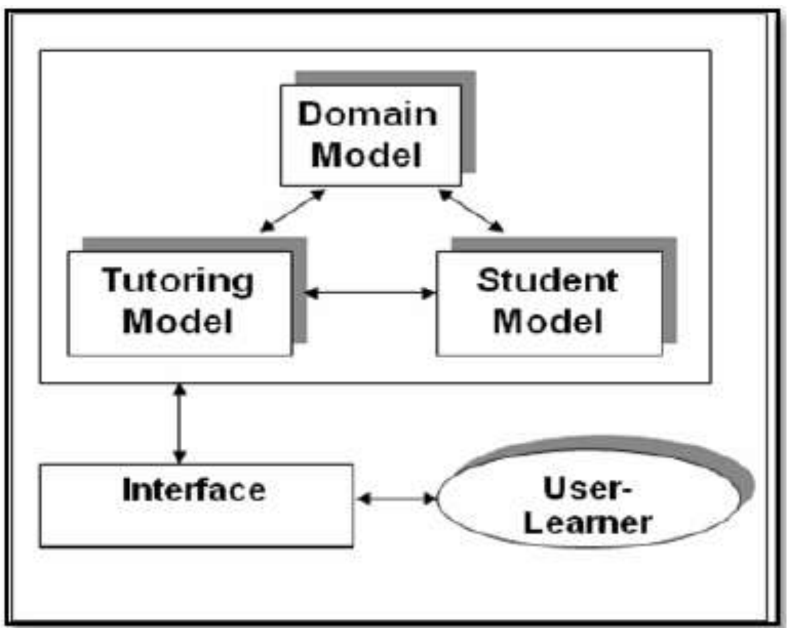

Fig.5 *The typical components of ITS (Nkambou, et al., 2010).*

ITS typical components (Phobun & Vicheanpanya, 2010):

(1) *Domain model:* It contains the domain expert knowledge and problem-solving ability. The knowledge representation in this model could use semantic networks or production rules. It supports other functions such as materials selection and representation, exercise selection, the generation of help and feedback, and evaluate the student's performance.

(2) *Student model:* This is the core component of any ITS. It contains information about the students' knowledge and affective states such as performance and motivation, these information come from analyzing the student interaction with the system.

(3) *Tutoring model (or Instructional Model):* receives input from the student and domain models and makes decisions about the best teaching style to be applied such as: the order of the lessons, when to move to the next level, and what, when, and how to give dialogs, help, hints, or feedback.

(4) *An Interface Model:* it's the communication medium between the student and the ITS. It's display the information and accept the input from the students.

In the literature, many research (e.g. Padayachee, 2002; Naser, 2016; Bulut Özek, Akpolat, & Orhan, 2013; Figueiredo & García-Peñalvo, 2020) present symmetric examples of the ITS architecture. Recently, there can be found some interesting research trying to answer the how and what should be included in each module (e.g Phobun and Vicheanpanya, 2010; Grivokostopoulou, Perikos, and Hatzilygeroudis, 2017). These types of research focus on a specific job that should be done by the ITS. Example of these researches, the architecture that is shown in Figure 6 that suggested by Grivokostopoulou, Perikos, and Hatzilygeroudis (2017), they present the architecture of an educational system that assessing students' performance, the name of the system is an Artificial Intelligence Teaching System (AITS). AITS generate adapted tests for the students using the "test generator unit". Actually, Test generator unit has the same work as the common "tutoring model"; its use the input of the domain knowledge and the collected information about the student to adapt the test to the student's knowledge level and needs. Moreover, AITS have the "Automatic Assessment unit" which have the same work as the common "student model"; it's analyzing the student's answers and detect the completeness and accuracy.

As can be seen from reviewing the ITS related work, the typical ITS should have at least four components (or Modules): Domain model, Student model, Tutoring model, and Interface model. However, the differences between the researches were about the structure and the work of each Module. Therefore, we suggest also to include IWTS same modules of the typical ITS with more details about the components and the connection between them.

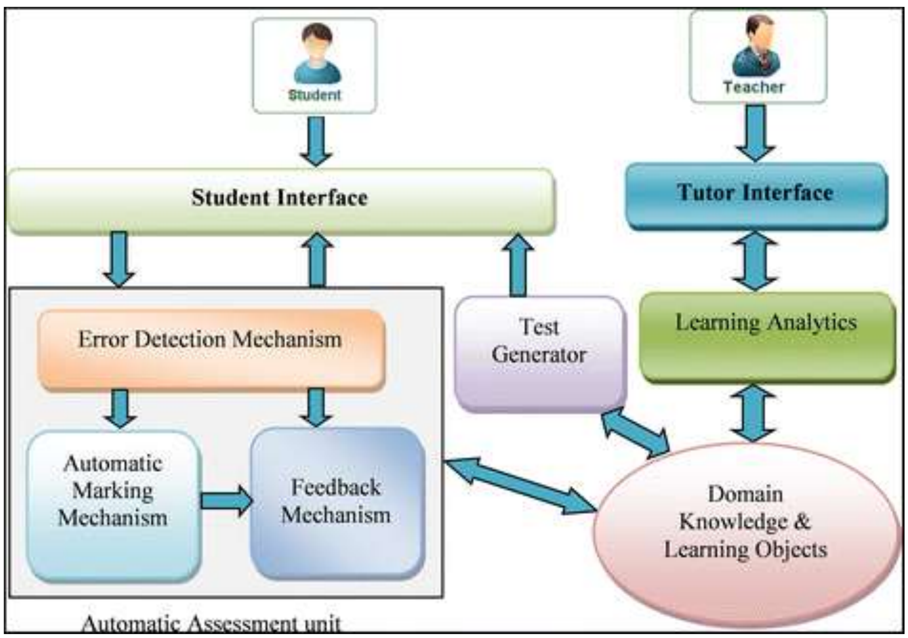

Fig.6 *An overview of AITS architecture (*Grivokostopoulou, *et al., 2017).*

3. IWTS ARCHITECTURE

This section presents the suggested architecture of IWTS, which can be seen in Figure 7. IWTS architecture was suggested based on the works reviewed in section 2.

The architecture of the IWTS divided into three sides:

(1) *Client side:* it's the web browser side that allows the student to open the IWTS web-based interface (website) and to interact with the tutoring system.

(2) *Application Server:* the main components of IWTS system located in this side. Moreover, this side represents the interface between the database server and the client side's requests.

(3) *Database Server:* has two types of the database, the system database and the knowledge base. System database contains the data that related to the work of the system such as the course contents and the students' data and so on. While, the knowledge base contains two types of the rules; motivational state rules and motivational tactics rules.

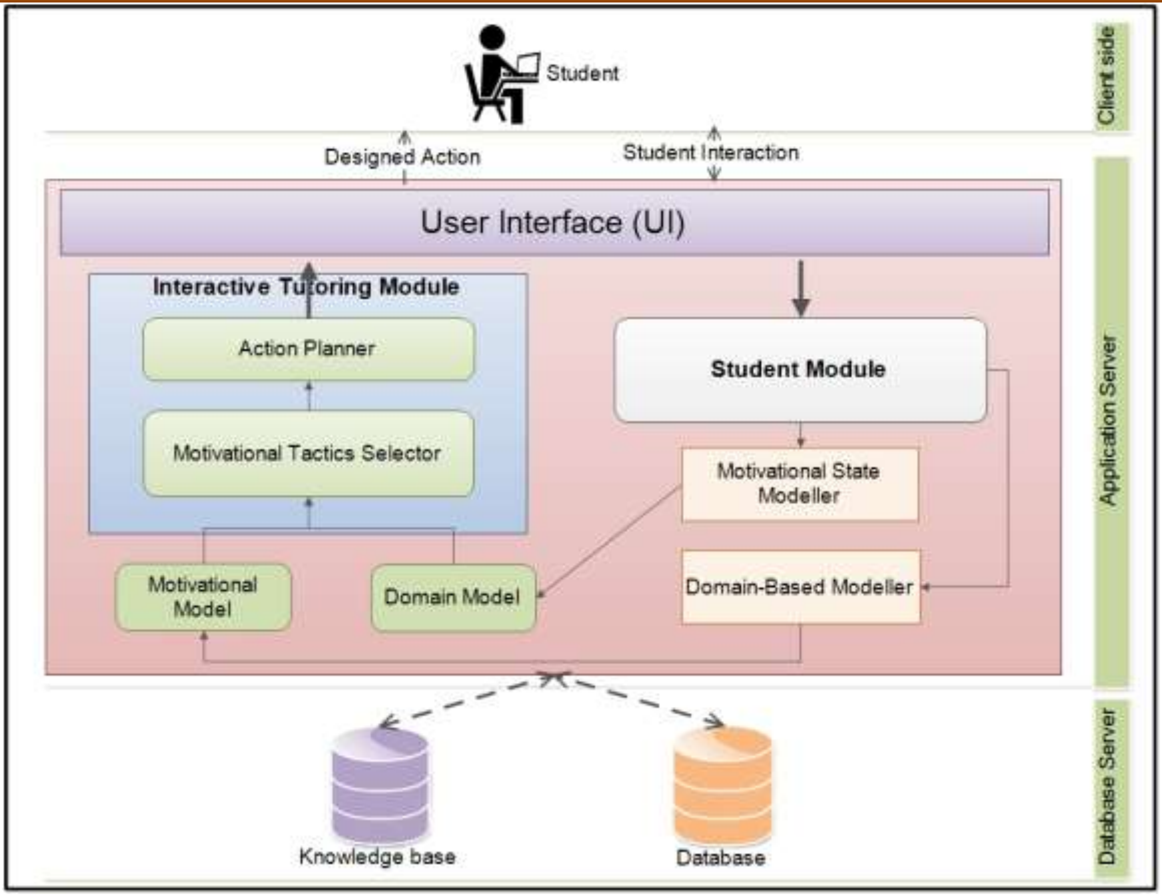

Fig.7 *IWTS Architecture*

The main components of the IWTS system:

(1) *Student Module:* this module responsible for gathering information about the students' motivation and cognitive states, these information usually generated from the interaction between the student and the tutoring system. Motivational state information is those information that helps the system (the **Motivational Modeller**) to analyze the student's motivation depending on a set of rules stored in the knowledge base, examples for those information are: the time spent performing the task, reading pages, the time from entering the page till finishing the task, and the mouse movements. While, student cognitive state information includes finishing the task successfully, finishing the task successfully (failing), giving up, and asking for help. Moreover, student module responsible for saving these collected information in the database and sending a copy to the **Domain-based modeller** and the **Motivational modeller**.

(2) *Motivational Modeller:* This modeller analyze the information coming from the **Student Module** such as the student's cognitive and motivational state information to generate the **Motivational Model**. The work of this modeller should depend on a set of predefined motivational state prediction rules stored in the knowledge base. However, depending on those prediction rules this modeller could use the previously stored information about the student from the database. Those information such as frequency of requesting help, the number of successfully completed tasks, and frequency of giving up. A copy of these analysed information could be stored in the database for future use.

(3) *Domain-based Modeller:* This modeller analyzes the student's cognitive information coming from the **Student Module** to generate the **Domain-based Model**. The work of this modeller should depend on a set of predefined domain-based production rules stored in the knowledge base. Moreover, the modeller should store a copy of these analyzed information in the database for future use.

(4) *Motivational Model:* contains information about the present motivational state of the student, this information come from the **Motivational Modeller**.

(5) *Domain-based Model:* contains information about the present knowledge state the student, this information come from the **Domain-based Modeller**.

(6) *Interactive Tutoring Module:* This module receives input from the domain-based model and motivational model to take decisions on what motivational tactics should be applied to retain the students' motivation. This module has two units:

- *Motivational Tactics Selector:* This unit depends on the student's Motivational Model and Domain-based Model to make decisions about the needed motivational tactics and actions to retain the student's motivation. Examples of these tactics: what is the level of next task, what type of dialogues needed to interact with the student, should the system give hint or help, and what is the needed feedback. Therefore, this unit will decide what and when to apply these tactics to retain the student's motivation.

- *Action Planner:* The job of this unit is how to apply and present the motivational tactics and actions that were specified by the Motivational Tactics Selector to the student.

(7) User Interface (UI): As IWTS considered as a Web-based learning environment, then the UI is a set of WebPages that connect the student to the core of the system, and work as an external representation of the motivational tactics and actions.

(8) The Knowledge base: is a database that has the necessary rules for the work of the Domain-based Modeller, the Motivational Modeller, and the Motivational Tactics Selector.

4. DISCUSSION AND FUTURE WORK

In this study, we have examined the challenge of presenting a well defined architecture for interactive web-based tutoring systems to be able to retain the students' motivation during the learning process. As this architecture can help the web-based tutoring systems developers to enhance their systems with the ability of retaining students' motivation. First step in this study was doing a comprehensive literature review for the fields of assessing motivation in e-learning, interactive e-learning, and intelligent tutoring systems. Thereafter, we created our suggested architecture for IWTS depending on the literature review. Our architecture has three-tiers: client side, application server, and database server. The main components of the IWTS system are: Student Module, Motivational Modeller, Domain-based Modeller, Motivational Model, Domain-based Mode, Interactive Tutoring Module, User Interface, and The Knowledge base. However, we are looking to perform an experimental study in the near future to evaluate our suggested IWTS architecture in term of retaining the students' motivation.

5. REFERENCES

[1] Alseelawi, N. S., Adnan, E. K., Hazim, H. T., Alrikabi, H., & Nasser, K. (2020). Design and implementation of an e-learning platform using N-TIER architecture.

[2] Ames, C., (1992). Classrooms: Goals, structures, and student motivation. Journal of educational psychology, 84(3), 261.

[3] Anderman, E.M. and Maehr, M.L., (1994_. Motivation and schooling in the middle grades. Review of educational Research, 64(2), 287-309.

[4] Arroyo, I., Woolf, B. P., Burelson, W., Muldner, K., Rai, D., & Tai, M., (2014). A multimedia adaptive tutoring system for mathematics that addresses cognition, metacognition and affect. International Journal of Artificial Intelligence in Education, 24(4), 387-426.

[5] Astleitner, H., Leutner, D., (2000). Designing instructional technology from an emotional perspective. Journal of Research on Computing in Education, 32(4), 497-510.

[6] Beck, J. (2004). Using response times to model student disengagement. Paper presented at the Proceedings of the ITS2004 Workshop on Social and Emotional Intelligence in Learning Environments.

[7] Bokhari, M. U., & Ahmad, S. (2013, September). Design for interactive e-learning based upon multi-agent system: I-MBLS. In Confluence 2013: The Next Generation Information Technology Summit (4th International Conference) (pp. 456-460). IET.

[8] Bruscato, A.M. and Baptista, J., (2021a). Teaching Modalities in Brazilian and Portuguese Universities: A Case Study on the Perception of Students and Professors in Times of Covid-19. Revista Brasileira de Educação, 26.

[9] Bruscato, A.M. and Baptista, J., (2021b). Synchronous and asynchronous distance learning of anaphora in foreign languages: an experimental study. Texto Livre: Linguagem e Tecnologia, 1-18.

[10] Brusilovsky, P. (1999). Adaptive and intelligent technologies for web-based eduction. Künstliche Intelligenz, 13(4), 19-25.

[11] Bulut Özek, M., Akpolat, Z. H., & Orhan, A. (2013). A web-based intelligent tutoring system for a basic control course. Computer Applications in Engineering Education, 21(3), 561-571.

[12] Butz, C. J., Hua, S., & Maguire, R. B. (2004). A web-based intelligent tutoring system for computer programming. Paper presented at the Web Intelligence, (2004). WI 2004. Proceedings. IEEE/WIC/ACM International Conference on.

[13] Cocea, M. (2006, June). Assessment of motivation in online learning environments. In International Conference on Adaptive Hypermedia and Adaptive Web-Based Systems (pp. 414-418). Springer, Berlin, Heidelberg.

[14] Cocea, M., & Weibelzahl, S. (2009). Log file analysis for disengagement detection in e-Learning environments. User Modeling and User-Adapted Interaction, 19(4), 341-385.

[15] Cocea, M., & Weibelzahl, S. (2011). Disengagement detection in online learning: Validation studies and perspectives. Learning Technologies, IEEE Transactions on, 4(2), 114-124.

[16] De Vicente, A. (2003). Towards tutoring systems that detect students' motivation: an investigation.

[17] de Vicente, A., & Pain, H. (1999a). Eliciting motivation diagnosis knowledge. Paper presented at the Proceedings of the 9th World Conference on AIED.

[18] de Vicente, A., & Pain, H. (1999b). Motivation self-report in ITS. Paper presented at the Proceedings of the Ninth World Conference on Artificial Intelligence in Education.

[19] del Soldato, T. (1994). Motivation in tutoring systems. University of Sussex, Available as Technical Report CSRP303.

[20] del Soldato, T. and du Boulay, B., (1995). Implementation of motivational tactics in tutoring systems. Journal of Artificial Intelligence in Education, 6, 337-378.

[21] Derbali, L., Chalfoun, P., & Frasson, C. (2011a). Assessment of learners' attention while overcoming errors and obstacles: An empirical study. Paper presented at the Artificial Intelligence in Education.

[22] Derbali, L., Chalfoun, P., & Frasson, C. (2011b). A theoretical and empirical approach in assessing: From serious games to an ITS. Paper presented at the FLAIRS.

[23] Elgamal, A. F., Abas, H. A., & Baladoh, E. S. (2013). An interactive e-learning system for improving web programming skills. Education and Information Technologies, 18(1), 29-46.

[24] Figueiredo, J., & García-Peñalvo, F. J. (2020, October). Intelligent Tutoring Systems approach to Introductory Programming Courses. In Eighth International Conference on Technological Ecosystems for Enhancing Multiculturality (pp. 34-39).

[25] Ghergulescu, I., & Muntean, C. H. (2010). Assessment of motivation in games based e-learning. Paper presented at the IADIS International Conference Cognition and Exploratory Learning in Digital Age (CELDA 2010), Timisoara, Romania.

[26] Grivokostopoulou, F., Perikos, I., & Hatzilygeroudis, I. (2017). An educational system for learning search algorithms and automatically assessing student performance. International Journal of Artificial Intelligence in Education, 27(1), 207-240.

[27] Hartnett, M., 2016. Motivation in online education. Singapore: Springer.

[28] Hendradi, P., Abd Ghani, M. K., Mahfuzah, S. N., Yudatama, U., Prabowo, N. A., & Widyanto, R. A. (2020). Artificial Intelligence Influence In Education 4.0 To Architecture Cloud Based E-Learning System. International Journal of Artificial Intelligence Research, 4(1), 30-38.

[29] Hershkovitz, A., & Nachmias, R. (2008). Developing a log-based motivation measuring tool. Paper presented at the EDM.

[30] Hrastinski, S., (2008). Asynchronous and synchronous e-learning. Educause quarterly, 31(4), 51-55.

[31] Hull, A., & du Boulay, B., (2015). Motivational and metacognitive feedback in SQL-Tutor*. Computer Science Education, 25(2), 238-256.

[32] Johnson, W. L. (2001). Pedagogical agents for web-based learning Web Intelligence: Research and Development (pp. 43-43): Springer.

[33] Keller, J. and Suzuki, K., (2004). Learner motivation and e-learning design: A multinationally validated process. Journal of educational Media, 29(3), 229-239.

[34] Kew, S.N., Petsangsri, S., Ratanaolarn, T. and Tasir, Z., (2018). Examining the motivation level of students in e-learning in higher education institution in Thailand: A case study. Education and Information Technologies, 23(6), 2947-2967.

[35] Kim, Y. S., Cha, H. J., Cho, Y. R., Yoon, T. B., & Lee, J.-H. (2007). An intelligent tutoring system with motivation diagnosis and planning. Paper presented at the 15th International Conference on Computers in Education.

[36] Lin, K.C., Wu, T.K. and Wang, T.B., (2010), August. Using competitive digital game-based learning to improve learning motivation. In IET International Conference on Frontier Computing. Theory, Technologies and Applications (128-132). IET.

[37] Masud, M. A. H., & Huang, X. (2012). An e-learning system architecture based on cloud computing. system, 10(11), 255-259.

[38] Methaneethorn, J. (2008). Towards motivation modelling within a computer game based learning environment: An empirical study. University of Glasgow.

[39] Miltiadou, M., & Savenye, W. C. (2003). Applying social cognitive constructs of motivation to enhance student success in online distance education. AACE journal, 11(1), 78-95.

[40] Naser, S. S. A. (2016). ITSB: An Intelligent Tutoring System Authoring Tool. Journal of Scientific and Engineering Research, 3(5).

[41] Nkambou, R., Mizoguchi, R., & Bourdeau, J. (2010). Advances in intelligent tutoring systems (Vol. 308): Springer.

[42] Padayachee, I. (2002, January). Intelligent tutoring systems: Architecture and characteristics. In Proceedings of the 32nd Annual SACLA Conference (pp. 1-8).

[43] Phobun, P., & Vicheanpanya, J. (2010). Adaptive intelligent tutoring systems for e-learning systems. Procedia-Social and Behavioral Sciences, 2(2), 4064-4069.

[44] Qu, L., & Johnson, W. (2005). Detecting the learner's motivational states in an interactive learning environment. Paper presented at the Proceedings of the 2005 conference on Artificial Intelligence in Education: Supporting Learning through Intelligent and Socially Informed Technology.

[45] Ramaha, N. T. (2017). EXTRACTION, VALIDATION, AND EVALUATION OF MOTIVATIONAL TACTICS RULES IN A WEB-BASED INTELLIGENT TUTORING SYSTEM (WITS) (Doctoral dissertation, Universiti Sains Malaysia).

[46] Ramaha, N.T., Basha, A.D., Ismail, W.M.F.W., Umer, I.N., (2015). Students' Motivation Is "Realistic Challenge": Online Courses. International journal of scientific & engineering research, 6(6), 1383-1386.

[47] Ramaha, N.T. and Ismail, W.M.F.W., (2012). Assessment of learner's motivation in web based e-learning. International journal of scientific & engineering research, 3(8), 1-5.

[48] Ramaha, N.T.A. and Karas, I.R. (2021). Maintain Learners' Motivation within Asynchronous E-Learning Environments: How Can Interactive Avatars Help?. European Journal of Advances in Engineering and Technology, 8(9), 9-14.

[49] Song, S., & Keller, J., (2001). Effectiveness of motivationally adaptive computer-assisted instruction on the dynamic aspects of motivation. Educational Technology Research and Development, 49(2), 5-22.

[50] Takemura, Y., Nagumo, H., Huang, K.-L., & Tsukamoto, H. (2008). Assessing the learners' motivation in the e-learning environments for programming education. In H. Leung, F. Li, R. Lau & Q. Li (Eds.), Advances in Web Based Learning – ICWL 2007 (Vol. 4823, pp. 355-366): Springer Berlin Heidelberg.

[51] Talib, A. M., & Alomary, F. O. (2018, April). An Interactive Distance Education and E-Learning System Based on Multi Agent System Architecture. In 2018 1st International Conference on Computer Applications & Information Security (ICCAIS) (pp. 1-6). IEEE.

[52] Veliyath, N., De, P., Allen, A. A., Hodges, C. B., & Mitra, A. (2019, April). Modeling students' attention in the classroom using eyetrackers. In Proceedings of the 2019 ACM Southeast Conference (pp. 2-9).

[53] Wang, H., Chignell, M., & Ishizuka, M. (2006). Empathic tutoring software agents using real-time eye tracking. Paper presented at the Proceedings of the 2006 Symposium on Eye Tracking Research & Applications.

[54] Weiner, B., (1985). An attributional theory of achievement motivation and emotion. Psychological review, 92(4), 548.

[55] Zhang, G., Cheng, Z., He, A., & Huang, T. (2003). A WWW-based learner's learning motivation detecting system. Paper presented at the Proceedings of International Workshop on" Research Directions and Challenge Problems in Advanced Information Systems Engineering", Honjo City, Japan.