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A Knowledge Based Tutoring System – Review

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Abstract:-**The popularization and widespread use of computers and communication technologies has led researchers into developing computer-assisted diagnostic and testing systems for use in the enhancement of learning. The use of expert knowledge systems in the teaching process has found significant application in recent years. The use of expert systems (ES) has traversed different areas including work environments. The paper surveys the application of expert knowledge systems today. Essentially, the paper evaluates the opinions brought forth by other authors. Consequently, the paper contrasts the opinions to construct the inherent themes within the development of ES. The discussion touches on issues such as development of the system, the evolution, and the challenges in the development and application of the systems as suggested by other authors. As a conclusion, the paper will observe the main themes emerging from the discussion.**

I. INTRODUCTION

Many researchers have engaged in many projects in the search for new paradigms in e-learning and the mobile space. Connectivity through the internet and computers has led to the development of diverse systems that allow developers to assess different models used in the development of ES. The diversity of learning environments has led to massive strides in the development of expert knowledge systems to facilitate easy teaching and reduce teachers' workload. The fact is that an expert tutor adapts lessons sequences and training speed with the characteristics and aptitude of the learner (Ong & Ramachandran, 2005). Consequently, the researcher can adjust the expression style with learners' mood and incorporate mental conditions of the learner.

An Intelligent Tutoring System is a machine based guideline apparatus that endeavors to give individualized guidelines in light of learner's instructive status. Different views exist on the development of ITS. The thought of utilizing machine for training backpedals to 40 years back with the foundation of Advanced Research and Projects Agency Net (Arpanet). In spite of the motivation behind the Arpanet, this system is additionally utilized for scholarly purposes. The explanation behind this is that the building squares of the system were colleges and scholastic focuses in the United States. Current electronic learning frameworks have been used since 20 years prior to the advancement of web conventions. An individual learner on the World Wide Web needs the accompanying instructional aid and backing. Original electronic learning frameworks can just fulfill the essential needs of the individual learner, "Access to learning materials," while the others oblige more progressive learning frameworks. The paper reviews the different approaches used in developing ITS (Punjaburee et al., 2010).

According to Salekhova et al. (2013), an expert is an individual with extraordinary information in a specific field of science, craftsmanship, art, and so forth. The expert with far reaching background has the abilities that permit him to take care of complex issues viably. Subsequently, the ES can be characterized as a machine system intended to reenact the capacity of a human-master to tackle the issue. ES comprises of: (a) graphical client interface, (b) learning base, (c) databases, (d) surmising motor, and (d) working memory, as summarized in the figure 1 shows.

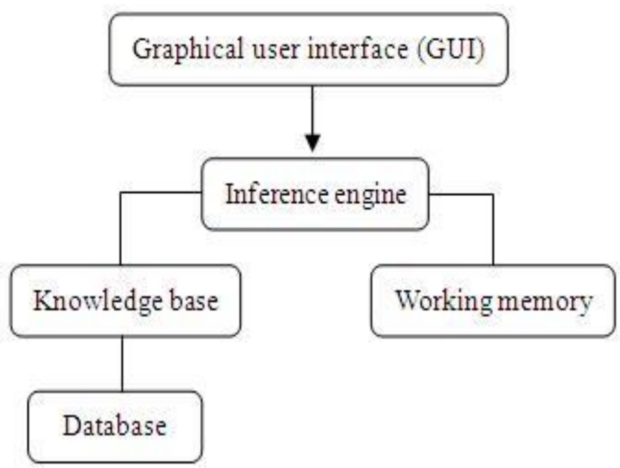

Fig. 1 ES Comprises System Architecture

The authors observe that the GUI allows a user to interact with the ES. Properly modeled graphical interface is a key factor of increasing the efficiency of using the system. The knowledge base contains all the rules according to which data is processed. The inference engine determines the method, according to which these rules will be used. All logical conclusions drawn from ES are stored in a working memory as long as the appropriate instructions are prompted data from the database. Inference engine often uses two strategies; these are forward backward/regressive chaining. Forward chaining is a top-down method, which takes realities as they become available and attempts to draw conclusions (from satisfied conditions in rules) which lead to the execution of actions. Regressive fastening is the converse. It is a base up strategy, which begins with objectives (or activities) and questions the client about data, which may fulfill the conditions contained in the guidelines. It is a check handle as opposed to an investigation process.

El-Shaik and Sticklen (1998) had identified a problem in the development of Intelligent Tutoring Systems with the incorporation of reusability. According to the authors, A genuine issue exists in the current strategy of creating Intelligent Tutoring Systems. Every application is created autonomously, and coaching ability is hard-coded into individual applications. There is next to no reuse of tutoring system. For example, the student model, mentoring model, and client interface, between applications face challenges because of the lack of a standard dialect for representing the ideas, a standard interface to permit applications access information, or a set of devices to allow architects to control the information. Therefore, the authors suggested that the development of an effective tutoring system should focus on the needs of the students and the mechanisms applicable in addressing the needs through instructional techniques.

Further, the authors classify knowledge into different categories to help in understanding the different student needs. Decisive knowledge includes knowledge concerning facts, vocabulary, and concepts. Procedural knowledge is exhibited when a student can combines decisive knowledge learning with the goal that it can be utilized as a part of an approach. Key information includes knowing when and how to utilize decisive and procedural learning to develop a learning result. Therefore, this sort of learning embodies the dynamic development of information and spots the understudy at the core of the instructing learning procedure. Fundamentally, learning from strategic construction of knowledge shows that instructions for the acquisition of skills should be given in a critical thinking setting. Along these lines, definitive and procedural knowledge can be changed into valuable learning results quickly. Learning is improved because the critical thinking setting gives a set of conditions encoding the relevance of the information and its importance to critical thinking objectives. This is the real trick of adapting by doing (Salekhova et al., 2013; Zarandi et al., 2012).

Lately, scientists have proposed different methodologies for creating versatile learning frameworks focused around the individual peculiarities or learning practices of understudies. Besides, models or instruments for diagnosing understudy learning issues and giving customized learning direction have been exhibited too. Among the current models, the Concept-Effect Relationship (CER) model, which shows the prerequisite ideas in a course, has become the most viable method for enhancing the learning. The CER model exhibits an orderly method for distinguishing the learning issues of students for every idea considered. Punjaburee et al. (2010) revisit the development of the CER. Hwang (2003a mentioned in Punjaburee et al., 2010) proposed the CER model to represent the connections among ideas that need to be adapted in a committed request. Such a model has been alluded to by a few specialists in creating testing and diagnostic instruments or frameworks for enhancing the learning process among students. In addition, different applications have uncovered the viability of the CER model. Case in point, Jong, Chan, and Wu (2007) (mentioned in Punjaburee et al., 2010) created a learning behavior diagnostic framework, which was connected to a computer course of a college and yielded positive trial results for both learning status and learning accomplishment. Meanwhile, Tseng et al. (2007) (mentioned in Punjaburee et al., 2010) utilized the CER model to give learning direction to individual understudies in the physical science course of a secondary school. Moreover, Punjaburee et al. (2010) reported the viability of the CER model in enhancing the learning accomplishments of students in a Mathematics course of a primary school.

II. SYSTEM ARCHITECTURE

Researchers concede that the collaboration between teachers in the education process is critical for the success of the Knowledge Based Tutoring Systems. Further, several researchers concede that interaction between teachers applying the systems is essential for effective communication, decision-making, and planning. Different studies find that teachers have their individual experiences in discussing and proposing their perspectives while collaborating with others. Essentially, the factors increase the success of the outcomes. For example, Hwang (2002) demonstrated the advantages of collaboration among teachers in the development of computer-based tutoring systems and environments. In creating a diagnostic model for the detection of the learning problems among students, it may be hard for an educator to address the greater part of the associations between the test items and the ideas. From the instructive viewpoint, the joint effort of educators in deciding such connections could be a viable approach to adapt to this issue.

However, the current trends in the development of ITS's has significantly changed over the years. The idea has traversed the academic labs to classrooms, and now in workplaces. Durrani and Durrani (2010) indicate the new developments that have arose in recent years regarding ITS. Intelligent systems can perceive the type of learner, select the proper course content from the database, and present it to learners in legitimate style. Moreover, it endeavors to mimic a human guide expertly and adroitly. Students utilizing these systems solve the issues and related sub-issues inside an objective space, and get criticism when their conduct wanders from that learner model. However, Punjaburee et al. (2012) concedes that the construction of a set of rules for the integration of opinions of teachers has become challenging as the systems become advanced.

The most challenging part in the development of expert systems entails the gathering of domain knowledge from a multiplicity of experts. Therefore, Punjaburee et al. (2012) suggest that the adoption of a set of rules should come as the first thing. This entails a suggested by Punjaburee et al. (2012) in the diagram in figure 2.

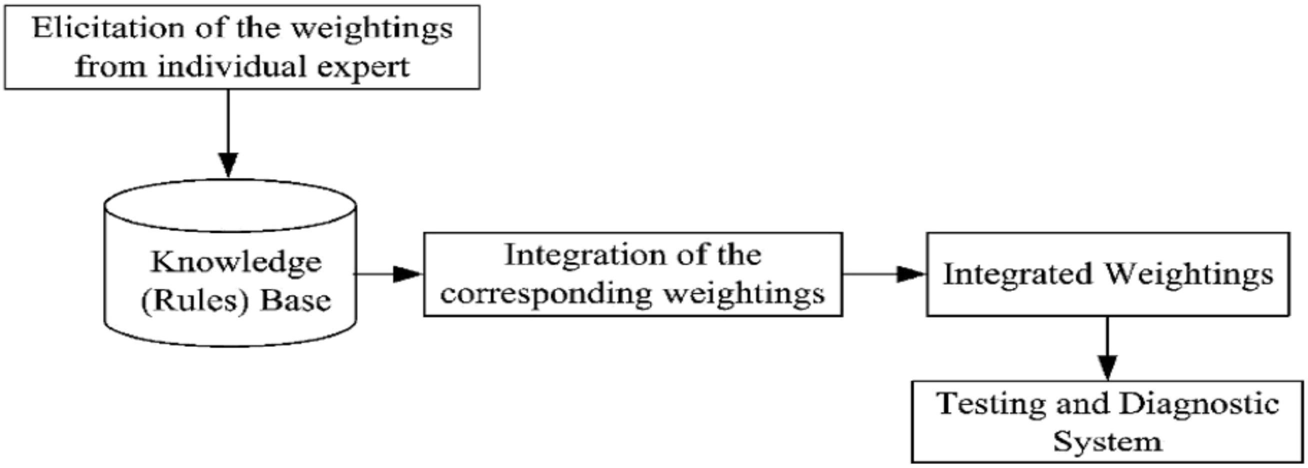

Fig. 2 Multi-Expert Weight Presetting Procedure

Essentially, different researchers have come up with different models to illustrate the components of Intelligent Tutoring Systems. El-Sheikh & Sticklen (1998) had suggested a simple model to depict the interaction of the elements involved in an ITS environment Figure 3.

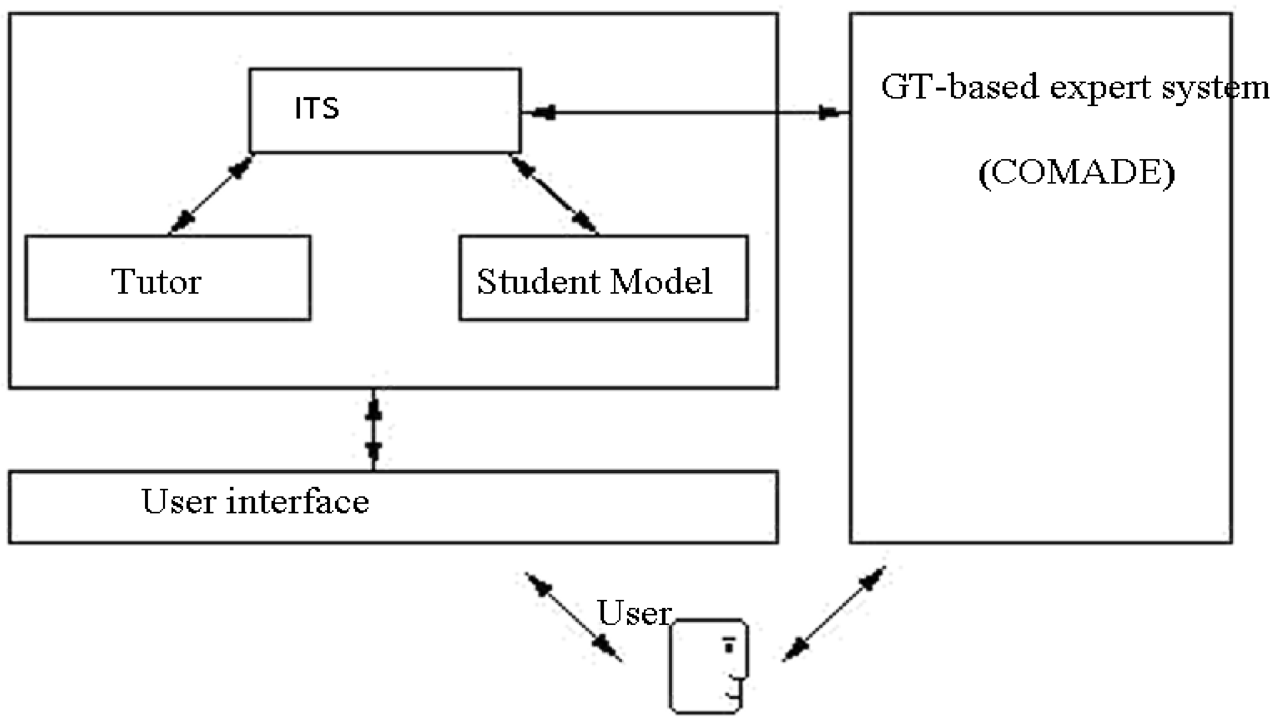

Fig. 3 Interaction of the Elements Involved in an ITS Environment

Ong & Ramachandran (2005) developed an almost similar model as illustrated in figure 4.

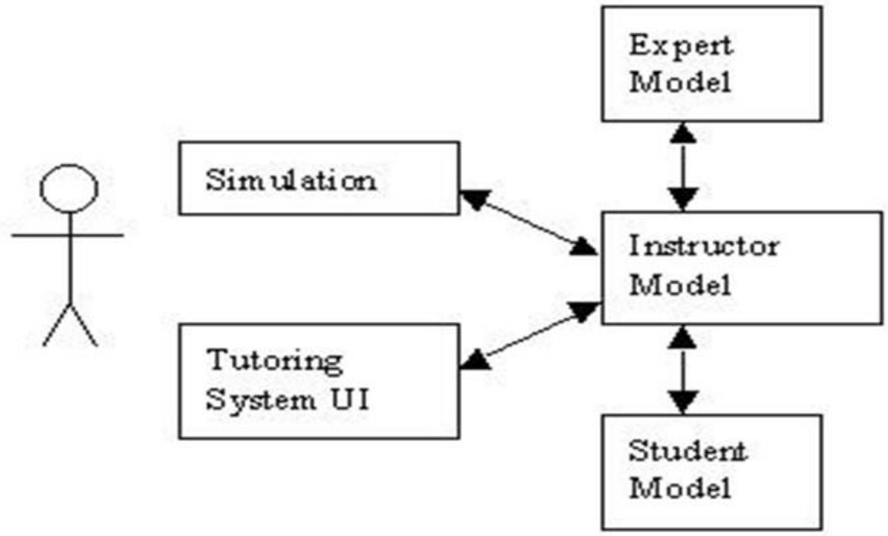

Fig. 4 Components of an Intelligent Tutoring System

Ghardilri & Rastgarpour (2012) suggested a more advanced model adding to the components contained in Ghadilri & Sticklen (2008) in figure 5.

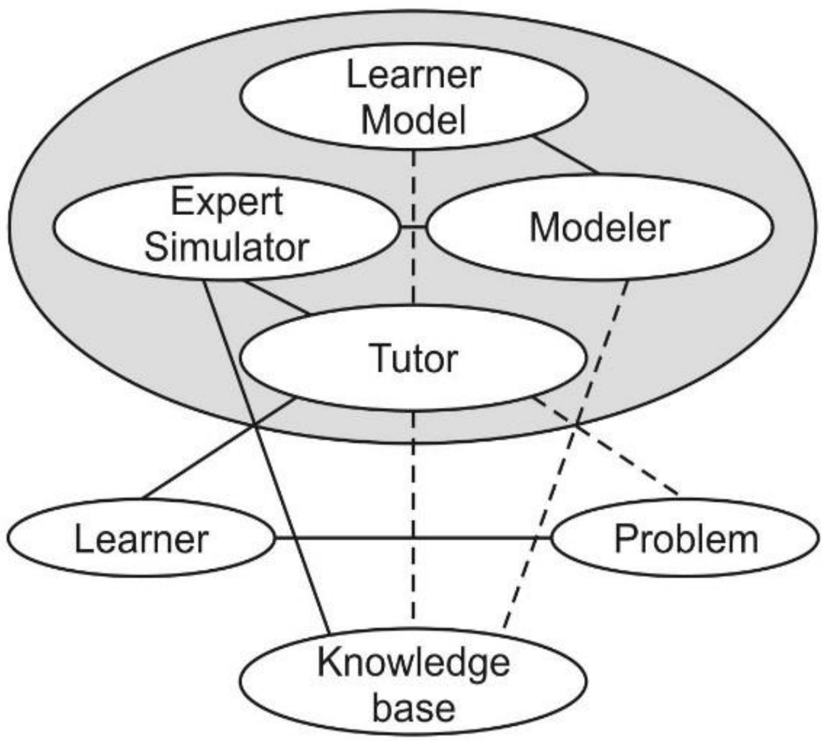

Fig. 5 Advanced Model

Essentially, different developers have developed models and systems citing their advantages over other existing systems. For example, Salekhova et al (2013) proposes a model with additional modules connected to the system to extend the system's capabilities in the adaptation to the specific teaching requirements. Figure 7 illustrates the suggested model.

Therefore, it is evident that different researchers have different perceptions towards the development of intelligent tutoring systems. Evidently, the systems have evolved from those with simple components to highly sophisticated systems. Essentially, numerous conventional instructional frameworks present learners with realities and ideas emulated by test inquiries. These strategies are successful in presenting individuals to data and testing their review. In any cases, they regularly ingrain "idle learning" that learners can review but may not make a difference accurately when required. By difference, ITS frameworks use reenactments and other exceedingly intelligent learning situations that oblige individuals to apply their insight and abilities. These dynamic, arranged learning situations help them hold and apply information and aptitudes all the more successfully in operational settings (Salekhova et al., 2013).

III. CHALLENGES

To give insights, direction, and instructional input to learners, ITS frameworks commonly depend on three sorts of learning, sorted out into partitioned programming modules (as indicated in Figure 1) . The "master model" speaks to topic mastery and gives the ITS learning of what its instructing. The "understudy model" speaks to what the client does and does not have the foggiest idea, and what he or she does and doesn't have. This learning tells the ITS who its instructing. The "teacher model" empowers the ITS to know how to educate, by encoding instructional techniques utilized by means of the coaching framework client interface.

Fundamentally, Menus focused around pecking orders of examination strategies can be utilized to give understudies in the mentoring methodology with conceivable decisions for data social affair activities. The creator has the capacity choose if the whole chain of importance or sub-orders is indicated to the understudy. It is additionally conceivable to center examination systems on anatomic structures by utilizing obtained connections between them. Overall, a menu essentially demonstrating an anatomic structure can be developed. Each sub-menu has an extra menu thing that pops up the agreeing examination techniques. Knowledge formalized within the architecture can be used for an automatic feedback generation in the tutoring process. The systems allow the quantitative or qualitative assessment of links between phenomena as done, for example, in the D3 expert systems.

Essentially, many authors maintain the opinion that ITS systems make the teaching process easy. Through multiple testing and evaluations, the systems can increase the efficiently and experience of the teaching process. According to Sakhelov et al. (2013) and Pranjaburee et al. (2012), many systems have the capability of testing and analyzing academic performance through simulation. Preliminary results on many systems also indicate that the use of expert knowledge systems simplifies teaching of hard subjects such as mathematics. Essentially, proper use of the systems can reduce a teacher's workload and allow more time for self-development and improvement of professionalism and competence. Therefore, many of the studies popularize the use of computers and technologies in the creation of modern systems of education.

However, the researchers have also cited the challenges in the application of the systems. First, Salekhova et al. (2013) suggests that inadequate training on the application of the systems will lead to problems associated with the analysis of academic performance. According to the author, the problem is common in many learning environments considering that one teacher have to deal with a number of classes with almost thirty students per class. Consequently, the analysis of performance for the students in a system that one does not know how to apply faces significant challenges. Additionally, the development of the system faces challenges in the development of problematic topics that represent the weakly learned topics. For example, if the topic "Fractional expressions" cannot be learned before "Rational expressions", it is not worth trying to eliminate the knowledge gap in a more complex topic "Fractional expressions" when a student has poorly learned a prerequisite topic "Rational expressions". Contrary, Punjaburee et al. (2012) assert that the most significant challenge entails the integration of opinions of multiple experts in the obtainment of high quality test item-concept relationships. Additionally, the authors identify a challenge in the identification and integration of weights given by different experts. Moreover, they observe that becomes an interesting and challenging issue to construct a set of rules to integrate the opinions of teachers.

IV. CONCLUSION

As observed, different researchers maintain notable differences regarding expert knowledge systems. However, authors have maintained consensus in several key issues regarding the development of expert knowledge systems. For example, the paper has identified a consensus between Punjaburee et al (2010) and Salekhov et al. (2012) regarding the ways in which a teacher can identify the student's problem. The authors have maintained consensus on most of the issues surrounding the development of ES. Notably, the authors apply the same model in explaining the learning path among learners. Further, the study has identified the similarity and advancement of the models used in developing or explaining the application of ES. The development has led to the development of systems that can detect the type of learners, the course content applicable, and the best teaching strategy. However, the authors also show consensus in opinion regarding the challenges in the execution of the systems.

Notably, the research identifies the gathering of domain knowledge from diverse experts as the key message communicated by different authors assessed. Nonetheless, the review indicates that regardless of the challenges, the application of ES can significantly reduce teachers' workload and simplify the teaching of hard subjects. Therefore, the paper assesses the nature of ES and finds that the development and application of ES and finds that the application of the systems can benefit both the teachers and the students in the learning environment.

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